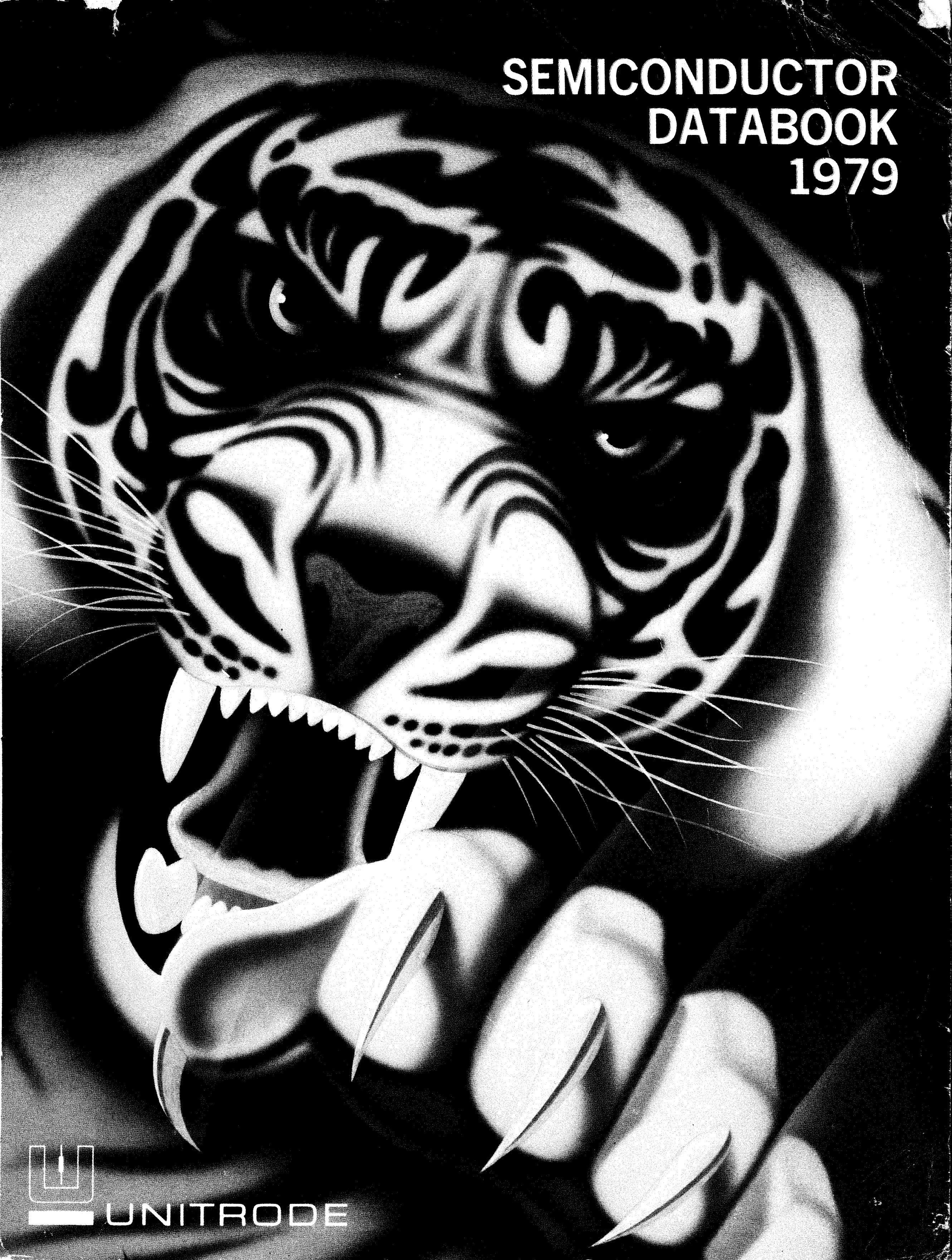
SEMICONDUCTOR DATABOOK 1979



UNITRODE

UNITRODE SEMICONDUCTOR DATABOOK 1979

Printed in U.S.A.

INTRODUCTION

From its inception 19 years ago, Unitrode has acquired a reputation for maintaining an unusually high level of quality, performance, and reliability in its entire line of silicon semiconductor devices. Excellence was first established with Unitrode's uniquely controlled avalanche, hard-glass passivated Rectifiers and Zener Diodes, and later expanded, through corporate acquisition, to include planar passivated low-power, high-speed SCRs, PUTs, and high-speed Power Transistors and Darlingtons.

Unitrode has been at the forefront in meeting the fast changing needs of industry. The Company has also developed (1) Doorbell® Rectifier Modules to provide reliable, economic solid-state rectifier tube replacements in high-voltage power supplies, (2) Diode Stacks that require no compensation, (3) SCRs fast enough for laser pulse modulators, (4) very high speed rectifiers designed for optimum performance in switching power supplies, (5) the first Hybrid Power Switching Circuits for Switching Regulator applications in the industry, (6) a new packaging concept called ChipStrate® for power thyristors, (7) fast turn-off power SCRs using ChipStrate techniques and (8) power transistors that significantly improve turnoff and $E_{S/b}$ characteristics by utilizing a new transistor design concept.

Doorbell® is a registered trademark of Unitrode Corporation
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Midwest Office, 440 East Dixie Drive, West Carrollton, OH 45449, Tel. (513)859-5872, TWX 810-473-2979
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TELEX: 851-28752

TERMS AND CONDITIONS

All factory orders are subject to a $250 minimum charge.*
Orders are F.O.B. factory.
Terms Net 30 days.

*Contact your Unitrode Representative for the name of the local Unitrode Distributor for the purchase of requirements under $250.

HIGH RELIABILITY SCREENING:

Unitrode offers a standard high reliability screening program called "HR 201 Screening" for most of its standard products. Parts with this screening can be ordered from the factory by calling out the Unitrode HR 201 specification applicable to the product being ordered. See section titled "Reliability Processing" for further information and the Unitrode O. E. M. Price List for costs.

INSULATED STUDS

Power Rectifiers and Zener Diodes with insulated studs can be ordered from the factory by adding a V or W suffix to the part number. See section titled "Packaging Data" under Applications for a detailed description of the V and W studs.

REVERSE POLARITY

To order Power Rectifiers or Zeners with reverse polarity (anode to stud) add an "R" suffix to the part number.

SPECIAL LEAD MATERIAL

For axial leaded Rectifiers or Zeners with special leads, add suffix M, Z, X, P, V, W, S, R, or Q to the part number. See section titled "Packaging Data" under Applications for a description of the available special leads.

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75	1N645J, JTX, JTXV	400mA; 270V
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		COMPUTER DIODE
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79	1N1188J, JTX	35A; 400V; DO-5
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91	1N4247, J, JTX, JTXV	1.0A; 600V
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*	1N4321	1.0W; 10%
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81	1N4454, J, JTX	200mA; 75V; DO-35
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99	1N4954-1N4995, J, JTX, JTXV	5.0W; 5%
99	1N4996	5.0W; 5%
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360	1N5059 (U14B)	1.0A; 200V
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*	1N5180	4.0A; 100V
*	1N5185	3.0A; 60V
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*	1N5207	4.0A; 400V
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*	1N5330	0.5A; 1500V
103	1N5415, J, JTX, JTXV	3A; 50V
103	1N5416, J, JTX, JTXV	3A; 100V
103	1N5417, J, JTX, JTXV	3A; 200V
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103	1N5419, J, JTX, JTXV	3A; 500V
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*	1N5433	2.0A; 700V
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105	1N5550, J, JTX, JTXV	5.0A; 200V
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105	1N5553, J, JTX, JTXV	5.0A; 800V
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107	1N5555, J, JTX	33V
107	1N5556, J, JTX	43.7V
107	1N5557, J, JTX	54V
107	1N5558, J, JTX	191V
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		TRANSIENT SUPPRESSOR
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112	1N5614, J, JTX, JTXV	1.0A; 200V
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114	1N5617, J, JTX, JTXV	1.0A; 400V
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114	1N5619, J, JTX, JTXV	1.0A; 600V
112	1N5620, J, JTX, JTXV	1.0A; 800V
		RECTIFIER
362	1N5624 (U15B)	3.0A; 200V
362	1N5625 (U15D)	3.0A; 400V

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

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PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER
362	1N5626 (U15M)	3.0A; 600V
362	1N5627 (U15N)	3.0A; 800V
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		RECTIFIER
116	1N5802	2.5A; 50V
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116	1N5803	2.5A; 75V
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116	1N5806	2.5A; 150V
120	1N5806, J, JTX, JTXV	2.5A; 150V
116	1N5807	6.0A; 50V
120	1N5807, J, JTX, JTXV	6.0A; 50V
116	1N5808	6.0A; 75V
116	1N5809	6.0A; 100V
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120	1N5811, J, JTX, JTXV	6.0A; 150V
116	1N5812	20.0A; 50V
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		PIN DIODE
52	1N5957	Low Distortion, AGC Diode
		SCR
*	2N876	.35A@100°C 15V; TO-18
*	2N877	.35A@100°C 30V; TO-18
*	2N878	.35A@100°C 60V; TO-18
*	2N879	.35A@100°C 100V; TO-18
*	2N880	.35A@100°C 150V; TO-18
*	2N881	.35A@100°C 200V; TO-18
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*	2N884	.35A@100°C 15V; TO-18
*	2N885	.35A@100°C 30V; TO-18
*	2N886	.35A@100°C 60V; TO-18
*	2N887	.35A@100°C 100V; TO-18
*	2N888	.35A@100°C 150V; TO-18
*	2N889	.35A@100°C 200V; TO-18
*	2N890	.35A@100°C 300V; TO-18
*	2N891	.35A@100°C 400V; TO-18
*	2N948	.26A@125°C 30V; TO-18
*	2N949	.26A@125°C 60V; TO-18
*	2N950	.26A@125°C 100V; TO-18
*	2N951	.26A@125°C 200V; TO-18
*	2N1595	1.0A@80°C 50V; TO-5
*	2N1596	1.0A@80°C 100V; TO-5
*	2N1597	1.0A@80°C 200V; TO-5
*	2N1598	1.0A@80°C 300V; TO-5
*	2N1599	1.0A@80°C 400V; TO-5
		TRANSISTOR
*	2N1647	NPN; 3.0A; 60V; TO-59
*	2N1648	NPN; 3.0A; 80V; TO-59
*	2N1649	NPN; 3.0A; 60V; TO-59
*	2N1650	NPN; 3.0A; 80V; TO-59
*	2N1714	NPN; 0.75A; 60V; TO-5
*	2N1715	NPN; 0.75A; 100V; TO-5
*	2N1716	NPN; 0.75A; 60V; TO-5

PAGE	PART NUMBER	DESCRIPTION
		TRANSISTOR
*	2N1717	NPN; 0.75A; 100V; TO-5
*	2N1718	NPN; 0.75A; 60V; TO-5 Stud Mount
*	2N1719	NPN; 0.75A; 100V; TO-5; Stud Mount
*	2N1720	NPN; 0.75A; 60V; TO-5; Stud Mount
*	2N1721	NPN; 0.75A; 100V; TO-5 Stud Mount
		SCR
*	2N1869	1.25A@100°C 15V; TO-9
125	2N1870A, J	1.25A@100°C 30V; TO-9
125	2N1871A, J	1.25A@100°C 60V; TO-9
125	2N1872A, J	1.25A@100°C100V; TO-9
125	2N1873A	1.25A@100°C 150V; TO-9
125	2N1874A, J	1.25A@100°C 200V; TO-9
129	2N1875	1.25A@100°C 15V; TO-9
129	2N1876	1.25A@100°C 30V; TO-9
129	2N1877	1.25A@100°C 60V; TO-9
129	2N1878	1.25A@100°C 100V; TO-9
129	2N1879	1.25A@100°C 150V; TO-9
129	2N1880	1.25A@100°C 200V; TO-9
131	2N1881	1.0A@100°C 30V; TO-9
131	2N1882	1.0A@100°C 60V; TO-9
131	2N1883	1.0A@100°C 100V; TO-9
131	2N1884	1.0A@100°C 150V; TO-9
131	2N1885	1.0A@100°C 200V; TO-9
*	2N2009	1.3A@80°C 25V; TO-5
*	2N2010	1.3A@80°C 50V; TO-5
*	2N2011	1.3A@80°C 100V; TO-5
*	2N2012	1.3A@80°C 200V; TO-5
*	2N2013	1.3A@80°C 300V; TO-5
*	2N2014	1.3A@80°C 400V; TO-5
		TRANSISTOR
*	2N2150	NPN; 2.0A; 80V; TO-59
133	2N2151, J, JTX	NPN; 2.0A; 80V; TO-59
		SCR
137	2N2322	1.6A@85°C 25V; TO-5
137	2N2323, J, JTX	1.6A@85°C 50V; TO-5
137	2N2323A, J, JTX	1.6A@85°C 50V; TO-5
137	2N2324, J, JTX	1.6A@85°C 100V; TO-5
137	2N2324A, J, JTX	1.6A@85°C 100V; TO-5
137	2N2325	1.6A@85°C 150V; TO-5
137	2N2325A	1.6A@85°C 150V; TO-5
137	2N2326, J, JTX	1.6A@85°C 200V; TO-5
137	2N2326A, J, JTX	1.6A@85°C 200V; TO-5
137	2N2327	1.6A@85°C 250V; TO-5
137	2N2327A	1.6A@85°C 250V; TO-5
137	2N2328, J, JTX	1.6A@85°C 300V; TO-5
137	2N2328A, J, JTX	1.6A@85°C 300V; TO-5
137	2N2329, J, JTX	1.6A@85°C 400V; TO-5
*	2N2344	1.6A@55°C 25V; TO-5
*	2N2345	1.6A@55°C 50V; TO-5
*	2N2346	1.6A@55°C 100V; TO-5
*	2N2347	1.6A@55°C 150V; TO-5
*	2N2348	1.6A@55°C 200V; TO-5
		TRANSISTOR
*	2N2657	NPN; 5.0A; 60V; TO-5
*	2N2658	NPN; 5.0A; 80V; TO-5
		SCR
*	2N2679	.35A@55°C 30V; TO-18
*	2N2680	.35A@55°C 60V; TO-18
*	2N2681	.35A@55°C 100V; TO-18
*	2N2682	.35A@55°C 200V; TO-18
*	2N2683	.28A@55°C 30V; TO-18
*	2N2684	.28A@55°C 60V; TO-18

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

II. PART NUMBER INDEX

PAGE	PART NUMBER	DESCRIPTION
		SCR
*	2N2685	.28A@55°C 100V; TO-18
*	2N2686	.28A@55°C 200V; TO-18
*	2N2687	.28A@55°C 30V; TO-18
*	2N2688	.28A@55°C 60V; TO-18
*	2N2689	.28A@55°C 100V; TO-18
*	2N2690	.28A@55°C 200V; TO-18
		TRANSISTOR
*	2N2858	NPN; 3A; 80V; TO-5
*	2N2859	NPN; 3A; 100V; TO-5
*	2N2877, 2N2878	NPN; 5A; 80V; TO-111
*	2N2879	NPN; 5A; 100V; TO-111
140	2N2880, J, JTX, JTXV	NPN; 5.0A; 80V; TO-59
*	2N2890, 2N2891	NPN; 5A; 80V; TO-5
*	2N2892, 2N2893	NPN; 5A; 80V; TO-59
*	2N2983	NPN; 3A; 80V; TO-5
*	2N2984	NPN; 3A; 120V; TO-5
*	2N2985	NPN; 3A; 80V; TO-5
*	2N2986	NPN; 3A; 120V; TO-5
*	2N2987	NPN; 1A; 80V; TO-5
*	2N2988	NPN; 1A; 100V; TO-5
*	2N2989	NPN; 1A; 80V; TO-5
*	2N2990	NPN; 1A; 100V; TO-5
*	2N2991	NPN; 1A; 80V; TO-5 Stud
*	2N2992	NPN; 1A; 100V; TO-5 Stud
*	2N2993	NPN; 1A; 80V; TO-5 Stud
*	2N2994, 2N2995	NPN; 1A; 100V; TO-5 Stud
		SCR
*	2N3001	.25A@55°C 30V; TO-18
*	2N3002	.25A@55°C 60V; TO-18
*	2N3003	.25A@55°C 100V; TO-18
*	2N3004	.25A@55°C 200V; TO-18
*	2N3005	.25A@55°C 30V; TO-18
*	2N3006	.25A@55°C 60V; TO-18
*	2N3007	.25A@55°C 100V; TO-18
*	2N3008	.25A@55°C 200V; TO-18
144	2N3027, J, JTX	500mA@100°C 30V; TO-18
144	2N3028, J, JTX	500mA@100*C 60V; TO-18
144	2N3029, J, JTX	500mA@100*C 100V; TO-18
144	2N3030, J, JTX	.5A@100*C 30V; TO-18
144	2N3031, J, JTX	.5A@100°C 60V; TO-18
144	2N3032, J, JTX	.5A@100°C 100V; TO-18
*	2N3254	.25A@55°C 15 V; TO-46
*	2N3255	.25A@55°C 30V; TO-46
*	2N3256	.25A@55°C 60V; TO-46
*	2N3257	.25A@55°C 15V; TO-46
*	2N3258	.25A@55°C 30V; TO-46
*	2N3259	.25A@55°C 60V; TO-46
*	2N3273	2.2A@85°C 100V; TO-5
*	2N3274	2.2A@85°C 200V; TO-5
*	2N3275	2.2A@85°C 300V; TO-5
*	2N3276	2.2A@85°C 400V; TO-5
		TRANSISTOR
150	2N3418, J, JTX, JTXV	NPN; 3.0A; 60V; TO-5
150	2N3419, J, JTX, JTXV	NPN; 3.0A; 80V; TO-5
150	2N3420, J, JTX, JTXV	NPN; 3.0A; 60V; TO-5
150	2N3421, J, JTX, JTXV	NPN; 3.0A; 80V; TO-5
*	2N3445	NPN; 7.5A; 60V; TO-3
*	2N3446	NPN; 7.5A; 80V; TO-3
*	2N3447	NPN; 7.5A; 60V; TO-3
*	2N3448	NPN; 7.5A; 80V; TO-3
*	2N3469	NPN; 5.0A; 25V; TO-5
		SCR
*	2N3555	1.6A; 30V; TO-5
*	2N3556	1.6A; 60V; TO-5
*	2N3557	1.6A; 100V; TO-5

PAGE	PART NUMBER	DESCRIPTION
		SCR
*	2N3558	1.6A; 200V; TO-5
*	2N3559	1.6A; 30V; TO-5
*	2N3560	1.6A; 60V; TO-5
*	2N3561	1.6A; 100V; TO-5
*	2N3562	1.6A; 200V; TO-5
		TRANSISTOR
*	2N3744	NPN; 5.0A; 40V; TO-111
*	2N3745	NPN; 5.0A; 60V; TO-111
*	2N3746	NPN; 5.0A; 80V; TO-111
*	2N3747	NPN; 5.0A; 40V; TO-111
*	2N3748	NPN; 5.0A; 60V; TO-111
140	2N3749, J, JTX, JTXV	NPN; 5.0A; 80V; TO-111
*	2N3750	NPN; 5.0A; 40V; TO-111
*	2N3751	NPN; 5.0A; 60V; TO-111
*	2N3752	NPN; 5.0A; 80V; TO-111
*	2N3850	NPN; 5.0A; 80V; TO-59
*	2N3851	NPN; 5.0A; 80V; TO-59
*	2N3852	NPN; 5.0A; 40V; TO-59
*	2N3853	NPN; 5.0A; 40V; TO-59
154	2N3996, J, JTX, JTXV	NPN; 5.0A; 80V; TO-111
154	2N3997, J, JTX, JTXV	NPN; 5.0A; 80V; TO-111
154	2N3998, J, JTX, JTXV	NPN; 5.0A; 80V; TO-59
154	2N3999, J, JTX, JTXV	NPN; 5.0A; 80V; TO-59
*	2N4000	NPN; 1.0A; 80V; TO-5
*	2N4001	NPN; 1.0A; 100V; TO-5
*	2N4070	NPN; 10.0A; 100V; TO-3
*	2N4075	NPN; 3.0A; 80V; TO-111
*	2N4076	NPN; 3.0A; 80V; TO-111
		SCR
*	2N4096	1.0A@25°C 50V; TO-46
*	2N4097	1.0A@25°C 100V; TO-46
*	2N4108	180mA@25°C 50V; TO-18
*	2N4109	180mA@25°C 100V; TO-18
*	2N4110	180mA@25°C 200V; TO-18
*	2N4144	250mA@75°C 15V; TO-18
*	2N4145	250mA@75°C 30V; TO-18
*	2N4146	250mA@75°C 60V; TO-18
*	2N4147	250mA@75°C 100V; TO-18
*	2N4148	250mA@75°C 150V; TO-18
*	2N4149	250mA@75°C 200V; TO-18
		TRANSISTOR
158	2N4150, J, JTX	NPN; 10.0A; 70V; TO-5
		SCR
*	2N4212	1.0A@85°C 25V; TO-5
*	2N4213	1.0A@85°C 50V; TO-5
*	2N4214	1.0A@85°C 100V; TO-5
*	2N4215	1.0A@85°C 150V; TO-5
*	2N4216	1.0A@85°C 200V; TO-5
*	2N4217	1.0A@85°C 250V; TO-5
*	2N4218	1.0A@85°C 300V; TO-5
*	2N4219	1.0A@85°C 400V; TO-5
		TRANSISTOR
*	2N4237-2N4239	NPN; 1.0A
*	2N4300	NPN; 2.0A
162	2N5038	NPN; 20.0A; 150V; TO-3
162	2N5039	NPN; 20.0A; 120V; TO-3
		SCR
166	2N5060	0.8A@70°C 30V; TO-92
166	2N5061	0.8A@70°C 60V; TO-92
166	2N5062	0.8A@70°C 100V; TO-92
166	2N5063	0.8A@70°C 150V; TO-92
166	2N5064	0.8A@70°C 200V; TO-92

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		TRANSISTOR
*	2N5074-2N5077	NPN; 3A; 200V; TO-59
*	2N5334	NPN; 3A; 60V; TO-39
*	2N5335-2N5337	NPN; 3A; 80V; TO-39
*	2N5338, 2N5339	NPN; 5A; 100V; TO-39
*	2N5346, 2N5347	NPN; 7A; 80V; TO-59
*	2N5348, 2N5349	NPN; 7A; 100V; TO-59
*	2N5477, 2N5478	NPN; 7A; 80V; TO-59
*	2N5479, 2N5480	NPN; 7A; 100V; TO-59
170	2N5487	NPN; 5A; 80V; TO-5 Low Profile
170	2N5487-1	NPN; 5A; 80V; TO-5
170	2N5487-3	NPN; 5A; 80V; TO-5 Stud
170	2N5488	NPN; 5A; 100V; TO-5 Low Profile
170	2N5488-1	NPN; 5A; 100V; TO-5
170	2N5488-3	NPN; 5A; 100V; TO-5 Stud
173	2N5552	NPN; 10A; 80V; TO-5
173	2N5552-4	NPN; 10A; 80V; TO-5 Stud
175	2N5658	NPN; 20A; 80V; TO-59
175	2N5659	NPN; 20A; 80V; TO-111
177	2N5660, J, JTX, JTXV	NPN; 3A; 200V; TO-66
177	2N5661, J, JTX, JTXV	NPN; 3A; 300V; TO-66
177	2N5662, J, JTX, JTXV	NPN; 3A; 200V; TO-5
177	2N5663, J, JTX, JTXV	NPN; 3A; 300V; TO-5
182	2N5664, J, JTX, JTXV	NPN; 5A; 200V; TO-66
182	2N5665, J, JTX, JTXV	NPN; 5A; 300V; TO-66
182	2N5666, J, JTX, JTXV	NPN; 5A; 200V; TO-5
182	2N5667, J, JTX, JTXV	NPN; 5A; 300V; TO-5
		SCR
187	2N5724	1.6A@85°C 60V; TO-5
187	2N5725	1.6A@85°C 100V; TO-5
187	2N5726	1.6A@85°C 200V; TO-5
187	2N5727	1.6A@85°C 300V; TO-5
187	2N5728	1.6A@85°C 400V; TO-5
		PUT
191	2N6027, 2N6028	375mW@25°C 40V; TO-90
		TRANSISTOR
*	2N6077	NPN; 7A; 300V; TO-66
*	2N6078	NPN; 7A; 275V; TO-66
		PUT
195	2N6119	400mW@25°C 40V; TO-18
195	2N6120	400mW@25°C 40V; TO-18
199	2N6137, J, JTX	400mW@25°C 40V; TO-18
199	2N6138, J, JTX	400mW@25°C 100V; TO-18
		TRANSISTOR
203	2N6232	NPN; 10A; 100V; TO-5
203	2N6232-4	NPN; 10A; 100V; TO-5 Stud
*	2N6233	NPN; 5A; 225V; TO-66
*	2N6234	NPN; 5A; 275V; TO-66
*	2N6235	NPN; 5A; 325V; TO-66
205	2N6306	NPN; 8.0A; 500V; TO-3
205	2N6307	NPN; 8.0A; 600V; TO-3
205	2N6308	NPN; 8.0A; 700V; TO-3
		SCR
*	2N6332	2.0A@80°C 30V; TO-39
*	2N6333	2.0A@80°C 50V; TO-39
*	2N6334	2.0A@80°C 100V; TO-39
*	2N6335	2.0A@80°C 200V; TO-39
*	2N6336	2.0A@80°C 300V; TO-39
*	2N6337	2.0A@80°C 400V; TO-39
		DARLINGTON
209	2N6350, J, JTX	NPN; 10.0A; 80V; TO-33
209	2N6351, J, JTX	NPN; 10.0A; 150V; TO-33
209	2N6352, J, JTX	NPN; 10.0A; 80V; TO-66
209	2N6353, J, JTX	NPN; 10.0A; 150V; TO-66

PAGE	PART NUMBER	DESCRIPTION
		TRANSISTOR
162	2N6354	NPN; 10.0A; 150V; TO-3
162	2N6496	NPN; 15.0A; 150V; TO-3
214	2N6510	NPN; 7.0A; 250V; TO-3
214	2N6511	NPN; 7.0A; 300V; TO-3
214	2N6512	NPN; 7.0A; 350V; TO-3
214	2N6513	NPN; 7.0A; 400V; TO-3
214	2N6514	NPN; 7.0A; 350V; TO-3
218	2N6544	NPN; 8.0A; 650V; TO-3
218	2N6545	NPN; 8.0A; 850V; TO-3
222	2N6564	0.8A;@70°C 300V; TO-92
222	2N6565	0.8A;@70°C 400V; TO-92
		SCR
224	2N6681 (IP200)	1A; 100V; TO-92
224	2N6682 (IP202)	1A; 200V; TO-92
224	2N6683 (IP204)	1A; 400V; TO-92
224	2N6684 (IP206)	1A; 600V; TO-92
224	2N6685 (IP208)	1A; 800V; TO-92
*	3L1015	0.5A@75°C 15V; TO-18
*	3L1030	0.5A@75°C 30V; TO-18
*	3L1060	0.5A@75°C 60V; TO-18
*	3L1100	0.5A@75°C 100V; TO-18
*	3L2015	0.5A@100°C 15V; TO-18
*	3L2030	0.5A@100°C 30V; TO-18
*	3L2060	0.5A@100°C 60V; TO-18
*	3L2100	0.5A@100°C 100V; TO-18
		PHOTO SCR
*	3P15	0.3A@50°C 15V; TO-18
*	3P30	0.3A@50°C 30V; TO-18
*	3P60	0.3A@50°C 60V; TO-18
*	3P100	0.3A@50°C 100V; TO-18
*	3P150	0.3A@50°C 150V; TO-18
*	3P200	0.3A@50°C 200V; TO-18
*	3P1020	0.3A@50°C 15V; TO-18
*	3P1021	0.3A@50°C 30V; TO-18
*	3P1022	0.3A@50°C 60V; TO-18
*	3P1023	0.3A@50°C 100V; TO-18
		FULL WAVE BRIDGE
226	469-1, J, JTX	1 ph; 10A; 200V
226	469-2, J, JTX	1 ph; 10A; 400V
226	469-3, J, JTX	1 ph; 10A; 600V
228	483-1J	3 ph; 25.0A; 200V
228	483-2J	3 ph; 25.0A; 400V
228	483-3J	3 ph; 25.0A; 600V
230	673-1	1 ph; 1.5A; 100V
230	673-2	1 ph; 1.5A; 200V
230	673-3	1 ph; 1.5A; 300V
230	673-4	1 ph; 1.5A; 400V
230	673-5	1 ph; 1.5A; 500V
230	673-6	1 ph; 1.5A; 600V
232	673-7	1 ph; H.V.; 1200V
232	673-7.5	1 ph; H.V.; 1800V
232	673-8	1 ph; H.V.; 2400V
232	673-8.5	1 ph; H.V.; 3000V
232	673-9	1 ph; H.V.; 3600V
232	673-10	1 ph; H.V.; 4200V
232	673-11	1 ph; H.V.; 4800V
232	673-12	1 ph; H.V.; 5000V
230	676-1	1 ph; 1.0A; 100V
230	676-2	1 ph; 1.0A; 200V
230	676-3	1 ph; 1.0A; 300V
230	676-4	1 ph; 1.0A; 400V
230	676-5	1 ph; 1.0A; 500V
230	676-6	1 ph; 1.0A; 600V
232	676-12	1 ph; H.V.; 1200V
232	676-18	1 ph; H.V.; 1800V

*Contact Unitrode for specifications and ratings.
Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		FULL WAVE BRIDGE
232	676-24	1 ph; H.V.; 2400V
232	676-30	1 ph; H.V.; 3000V
232	676-36	1 ph; H.V.; 3600V
232	676-42	1 ph; H.V.; 4200V
232	676-48	1 ph; H.V.; 4800V
232	676-50	1 ph; H.V.; 5000V
235	678-1	3 ph; 25.0A; 100V
235	678-2	3 ph; 25.0A; 200V
235	678-3	3 ph; 25.0A; 300V
235	678-4	3 ph; 25.0A; 400V
235	678-5	3 ph; 25.0A; 500V
235	678-6	3 ph; 25.0A; 600V
238	679-1	1 ph; 25.0A; 100V
238	679-2	1 ph; 25.0A; 200V
238	679-3	1 ph; 25.0A; 300V
238	679-4	1 ph; 25.0A; 400V
238	679-5	1 ph; 25.0A; 500V
238	679-6	1 ph; 25.0A; 600V
238	680-1	1 ph; 10.0A; 100V
238	680-2	1 ph; 10.0A; 200V
238	680-3	1 ph; 10.0A; 300V
238	680-4	1 ph; 10.0A; 400V
238	680-5	1 ph; 10.0A; 500V
238	680-6	1 ph; 10.0A; 600V
		DOUBLER OR CENTER TAP
241	681-1	15.0A; 100V
241	681-2	15.0A; 200V
241	681-3	15.0A; 300V
241	681-4	15.0A; 400V
241	681-5	15.0A; 500V
241	681-6	15.0A; 600V
		FULL WAVE BRIDGE
235	682-1	3 ph; 20.0A; 100V
235	682-2	3 ph; 20.0A; 200V
235	682-3	3 ph; 20.0A; 300V
235	682-4	3 ph; 20.0A; 400V
235	682-5	3 ph; 20.0A; 500V
235	682-6	3 ph; 20.0A; 600V
238	683-1	1 ph; 20.0A; 100V
238	683-2	1 ph; 20.0A; 200V
238	683-3	1 ph; 20.0A; 300V
238	683-4	1 ph; 20.0A; 400V
238	683-5	1 ph; 20.0A; 500V
238	683-6	1 ph; 20.0A; 600V
238	684-1	1 ph; 10.0A; 100V
238	684-2	1 ph; 10.0A; 200V
238	684-3	1 ph; 10.0A; 300V
238	684-4	1 ph; 10.0A; 400V
238	684-5	1 ph; 10.0A; 500V
238	684-6	1 ph; 10.0A; 600V
243	685-2.5	3 ph; 2.5KV
243	685-3	3 ph; 3.0KV
243	685-4	3 ph; 4.0KV
243	685-5	3 ph; 5.0KV
243	685-7	3 ph; 7.0KV
245	686-2.5	1 ph; 2.5KV
245	686-3	1 ph; 3.0KV
245	686-4	1 ph; 4.0KV
245	686-5	1 ph; 5.0KV
245	686-7	1 ph; 7.0KV
		RECTIFIER STACK
247	688-10	10.0KV
247	688-12	12.0KV
247	688-15	15.0KV

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER STACK
247	688-18	18.0KV
247	688-20	20.0KV
247	688-25	25.0KV
		DOUBLER OR CENTER TAP
241	689-1	15.0A; 100V
241	689-2	15.0A; 200V
241	689-3	15.0A; 300V
241	689-4	15.0A; 400V
241	689-5	15.0A; 500V
241	689-6	15.0A; 600V
		FULL WAVE BRIDGE
235	695-1	3ph; 15.0A; 100V
235	695-2	3ph; 15.0A; 200V
235	695-3	3ph; 15.0A; 300V
235	695-4	3ph; 15.0A; 400V
235	695-5	3ph; 15.0A; 500V
235	695-6	3ph; 15.0A; 600V
235	696-1	3ph; 15.0A; 100V
235	696-2	3ph; 15.0A; 200V
235	696-3	3ph; 15.0A; 300V
235	696-4	3ph; 15.0A; 400V
235	696-5	3ph; 15.0A; 500V
235	696-6	3ph; 15.0A; 600V
249	697-1	1 ph; 2.5A; 100V
249	697-2	1 ph; 2.5A; 200V
249	697-3	1 ph; 2.5A; 300V
249	697-4	1 ph; 2.5A; 400V
249	697-5	1 ph; 2.5A; 500V
249	697-6	1 ph; 2.5A; 600V
249	698-1	1 ph; 2.25A; 100V
249	698-2	1 ph; 2.25A; 200V
249	698-3	1 ph; 2.25A; 300V
249	698-4	1 ph; 2.25A; 400V
249	698-5	1 ph; 2.25A; 500V
249	698-6	1 ph; 2.25A; 600V
251	700-1	3 ph; 2.5A; 100V
251	700-2	3 ph; 2.5A; 200V
251	700-3	3 ph; 2.5A; 300V
251	700-4	3 ph; 2.5A; 400V
251	700-5	3 ph; 2.5A; 500V
251	700-6	3 ph; 2.5A; 600V
251	701-1	3 ph; 2.25A; 100V
251	701-2	3 ph; 2.25A; 200V
251	701-3	3 ph; 2.25A; 300V
251	701-4	3 ph; 2.25A; 400V
251	701-5	3 ph; 2.25A; 500V
251	701-6	3 ph; 2.25A; 600V
253	800-1	3 ph; 40.0A; 50V
253	800-2	3 ph; 40.0A; 100V
253	800-3	3 ph; 40.0A; 125V
253	800-4	3 ph; 40.0A; 150V
253	801-1	3 ph; 20.0A; 50V
253	801-2	3 ph; 20.0A; 100V
253	801-3	3 ph; 20.0A; 125V
253	801-4	3 ph; 20.0A; 150V
256	802-1	1 ph; 35.0A; 50V
256	802-2	1 ph; 35.0A; 100V
256	802-3	1 ph; 35.0A; 125V
256	802-4	1 ph; 35.0A; 150V
256	803-1	1 ph; 20.0A; 50V
256	803-2	1 ph; 20.0A; 100V
256	803-3	1 ph; 20.0A; 125V
256	803-4	1 ph; 20.0A; 150V

*Contact Unitrode for specifications and ratings.
Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		DOUBLER OR CENTER TAP
259	804-1	20.0A; 50V
259	804-2	20.0A; 100V
259	804-3	20.0A; 125V
259	804-4	20.0A; 150V
		SCR
*	AA1	±25mA@80°C 400V; TO-18
*	AA2	±25mA@80°C 300V; TO-18
*	AA3	±25mA@80°C 200V; TO-18
262	AA100	0.5A@100°C 60V; TO-18
262	AA101	0.5A@100°C 100V; TO-18
262	AA102	0.5A@100°C 200V; TO-18
262	AA103	0.5A@100°C 300V; TO-18
262	AA104	0.5A@100°C 400V; TO-18
262	AA107	0.5A@100°C 60V; TO-18
262	AA108	0.5A@100°C 100V; TO-18
262	AA109	0.5A@100°C 200V; TO-18
262	AA110	0.5A@100°C 300V; TO-18
262	AA111	0.5A@100°C 400V; TO-18
262	AA114	0.5A@100°C 60V; TO-18
262	AA115	0.5A@100°C 100V; TO-18
262	AA116	0.5A@100°C 200V; TO-18
262	AA117	0.5A@100°C 300V; TO-18
262	AA118	0.5A@100°C 400V; TO-18
265	AD100	1.6A@85°C 60V; TO-5
265	AD101	1.6A@85°C 100V; TO-5
265	AD102	1.6A@85°C 200V; TO-5
265	AD103	1.6A@85°C 300V; TO-5
265	AD104	1.6A@85°C 400V; TO-5
265	AD107	1.6A@85°C 60V; TO-5
265	AD108	1.6A@85°C 100V; TO-5
265	AD109	1.6A@85°C 200V; TO-5
265	AD110	1.6A@85°C 300V; TO-5
265	AD111	1.6A@85°C 400V; TO-5
265	AD114	1.6A@85°C 60V; TO-5
265	AD115	1.6A@85°C 100V; TO-5
265	AD116	1.6A@85°C 200V; TO-5
265	AD117	1.6A@85°C 300V; TO-5
265	AD118	1.6A@85°C 400V; TO-5
*	BA150	0.5@100°C 30V; TO-18
*	BA151	0.5@100°C 60V; TO-18
*	BA152	0.5@100°C 100V; TO-18
*	CB200	0.5@100°C 30V; TO-18
*	CB201	0.5@100°C 60V; TO-18
*	CB202	0.5@100°C 100V; TO-18
*	CB203	0.5@100°C 200V; TO-18
*	CD200	1.6A@85°C 30V; TO-5
*	CD201	1.6A@85°C 60V; TO-5
*	CD202	1.6A@85°C 100V; TO-5
*	CD203	1.6A@85°C 200V; TO-5
268	CM100	5.0A@100°C 60V; TO-59
268	CM101	5.0A@100°C 100V; TO-59
268	CM102	5.0A@100°C 200V; TO-59
268	CM103	5.0A@100°C 300V; TO-59
268	CM104	5.0A@100°C 400V; TO-59
		TRIAC
270	CSB20	25A; 200V
270	CSB40	25A; 400V
270	CSB60	25A; 600V
		SCR
272	GA100	400mA@100°C 30V; TO-18
272	GA101	400mA@100°C 60V; TO-18
272	GA102	400mA@100°C 80V; TO-18
276	GA200-GA200A	60V; TO-18
276	GA201-GA201A	100V; TO-18

PAGE	PART NUMBER	DESCRIPTION
		SCR
279	GA300-GA300A	60V; TO-18
279	GA301-GA301A	100V; TO-18
276	GB200-GB200A	60V; TO-59
276	GB201-GB201A	100V; TO-59
279	GB300-GB300A	60V; TO-59
279	GB301-GB301A	100V; TO-59
282	ID100	0.5A@100°C 30V; TO-18
282	ID101	0.5A@100°C 60V; TO-18
282	ID102	0.5A@100°C 100V; TO-18
282	ID103	0.5A@100°C 150V; TO-18
282	ID104	0.5A@100°C 200V; TO-18
282	ID105	0.5A@100°C 300V; TO-18
282	ID106	0.5A@100°C 400V; TO-18
285	ID200	1.6A@70°C 50V; TO-5
285	ID201	1.6A@70°C 100V; TO-5
285	ID202	1.6A@70°C 150V; TO-5
285	ID203	1.6A@70°C 200V; TO-5
285	ID300	1.6A@70°C 300V; TO-5
285	ID301	1.6A@70°C 400V; TO-5
287	IP100	0.8A@70°C 30V; TO-92
287	IP101	0.8A@70°C 60V; TO-92
287	IP102	0.8A@70°C 100V; TO-92
287	IP103	0.8A@70°C 150V; TO-92
287	IP104	0.8A@70°C 200V; TO-92
287	IP105	0.8A@70°C 300V; TO-92
287	IP106	0.8A@70°C 400V; TO-92
224	IP200 (2N6681)	1A; 100V; TO-92
224	IP202 (2N6682)	1A; 200V; TO-92
224	IP204 (2N6683)	1A; 400V; TO-92
224	IP206 (2N6684)	1A; 600V; TO-92
224	IP208 (2N6685)	1A; 800V; TO-92
		TRIAC
291	L1B04302F	30A; 200V
291	L1B04304F	30A; 400V
291	L1B04306F	30A; 600V
291	L1B04308F	30A; 800V
293	L1B05402F	40A; 200V
293	L1B05404F	40A; 400V
293	L1B05406F	40A; 600V
293	L1B05408F	40A; 800V
295	L1R04402F	40A; 200V
295	L1R04404F	40A; 400V
295	L1R04406F	40A; 600V
295	L1R04408F	40A; 800V
297	L1R05552F	55A; 200V
297	L1R05554F	55A; 400V
297	L1R05556F	55A; 600V
297	L1R05558F	55A; 800V
299	L2B06202F	20A; 200V
299	L2B06204F	20A; 400V
299	L2B06206F	20A; 600V
299	L2B06208F	20A; 800V
		SCR
301	L2R06102FG	10A; 200V; Fast Turn-on
301	L2R06104FG	10A; 400V; Fast Turn-on
301	L2R06106FG	10A; 600V; Fast Turn-on
301	L2R06108FG	10A; 800V; Fast Turn-on
304	L2R06252F	25A; 200V
304	L2R06254F	25A; 400V
304	L2R06256F	25A; 600V
304	L2R06258F	25A; 800V

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Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		TRIAC
306	L7B08102S	10A; 200V
306	L7B08104S	10A; 400V
306	L7B08106S	10A; 600V
306	L7B08108S	10A; 800V
308	L7B09032S	3A; 200V
308	L7B09034S	3A; 400V
308	L7B09036S	3A; 600V
308	L7B09038S	3A; 800V
		SCR
310	L7RA9042S	4A; 200V; Sens. Gate
310	L7RA9044S	4A; 400V; Sens. Gate
310	L7RA9046S	4A; 600V; Sens. Gate
310	L7RA9048S	4A; 800V; Sens. Gate
312	L7R08052SG	5A; 200V; Sens. Gate
312	L7R08054SG	5A; 400V; Fast Turn-on
312	L7R08056SG	5A; 600V; Fast Turn-on
312	L7R08058SG	5A; 800V; Fast Turn-on
315	L7R08152S	15A; 200V
315	L7R08154S	15A; 400V
315	L7R08156S	15A; 600V
315	L7R08158S	15A; 800V
		PUT
317	P13T1	375mW@25°C 40V; TO-92
317	P13T2	375mW@25°C 40V; TO-92
		PHOTO SCR
321	PF30-PF30A	300mA@50°C 30V; TO-18
321	PF60-PF60A	300mA@50°C 60V; TO-18
321	PF100-PF100A	300mA@50°C 100V; TO-18
321	PF200-PF200A	300mA@50°C 200V; TO-18
		SWITCHING REGULATOR POWER CIRCUIT
326	PIC600	5.0A; 60V (Pos.); TO-66
326	PIC601	5.0A; 80V (Pos.); TO-66
326	PIC602	5.0A; 100V (Pos.); TO-66
326	PIC610	5.0A; 60V (Neg.); TO-66
326	PIC611	5.0A; 80V (Neg.); TO-66
326	PIC612	5.0A; 100V (Neg.); TO-66
330	PIC625	15.0A; 60V (Pos.); TO-66
330	PIC626	15.0A; 80V (Pos.); TO-66
330	PIC627	15.0A; 100V (Pos.); TO-66
330	PIC635	15.0A; 60V (Neg.); TO-66
330	PIC636	15.0A; 80V (Neg.); TO-66
330	PIC637	15.0A; 100V (Neg); TO-66
334	PIC645	15.0A; 60V (Pos.); TO-3
334	PIC646	15.0A; 80V (Pos.); TO-3
334	PIC647	15.0A; 100V (Pos.); TO-66
334	PIC655	15.0A; 60V (Neg.); TO-3
334	PIC656	15.0A; 80V (Neg.); TO-3
334	PIC657	15.0A; 100V (Neg.); TO-66
		SCHOTTKY RECTIFIER
338	SD51	60A; 45V; DO-5
		FULL WAVE BRIDGE
341	SPA25, J	1 ph; 25.0A; 100V
341	SPB25, J	1 ph; 25.0A; 200V
341	SPC25, J	1 ph; 25.0A; 400V
341	SPD25, J	1 ph; 25.0A; 600V
		TRANSIENT VOLTAGE SUPPRESSOR
343	TVS505	500W; 5.0V
343	TVS510	500W; 10.0V
343	TVS512	500W; 12.0V
343	TVS515	500W; 15.0V
343	TVS518	500W; 18.0V
343	TVS524	500W; 24.0V
343	TVS528	500W; 28.0V

PAGE	PART NUMBER	DESCRIPTION
		DARLINGTON
348	U2T101	NPN; 10.0A; 80V; TO-33
348	U2T105	NPN; 10.0A; 150V; TO-33
348	U2T201	NPN; 10.0A; 80V; TO-66
348	U2T205	NPN; 10.0A; 150V; TO-66
350	U2T301	NPN; 5.0A; 60V; TO-33
350	U2T305	NPN; 5.0A; 150V; TO-33
350	U2T401	NPN; 5.0A; 60V; TO-66
350	U2T405	NPN; 5.0A; 150V; TO-66
352	U2T712	NPN; 5.0A; 200V; TO-33
352	U2T713	NPN; 5.0A; 300V; TO-33
352	U2T722	NPN; 5.0A; 200V; TO-66
352	U2T723	NPN; 5.0A; 300V; TO-66
354	U2T822	NPN; 5.0A; 200V; TO-66
354	U2T823	NPN; 10.0A; 300V; TO-66
354	U2T832	NPN; 10.0A; 200V; TO-3
354	U2T833	NPN; 10.0A; 300V; TO-3
356	U2TA506	NPN; 3.0A; 60V; TO-92
356	U2TA508	NPN; 3.0A; 80V; TO-92
356	U2TA510	NPN; 3.0A; 100V; TO-92
		PUT
358	U13T1	400mW@25°C 40V; TO-18
358	U13T2	400mW@25°C 40V; TO-18
358	U13T3	400mW@25°C 100V; TO-18
358	U13T4	400mW@25°C 100V; TO-18
		RECTIFIER
360	U14A	1.0A; 100V
360	U14B (1N5059)	1.0A; 200V
360	U14D (1N5060)	1.0A; 400V
360	U14F	1.0A; 50V
360	U14M (1N5061)	1.0A; 600V
360	U14N (1N5062)	1.0A; 800V
360	U14P	1.0A; 1,000 V
362	U15A	3.0A; 100V
362	U15B (1N5624)	3.0A; 200V
362	U15D (1N5625)	3.0A; 400V
362	U15F	3.0A; 50V
362	U15M (1N5626)	3.0A; 600V
362	U15N (1N5627)	3.0A; 800V
364	U114A	1.0A; 100V
364	U114B	1.0A; 200V
364	U114C	1.0A; 300V
364	U114D	1.0A; 400V
364	U114E	1.0A; 500V
364	U114F	1.0A; 50V
364	U114M	1.0A; 600V
364	U114N	1.0A; 800V
366	U115A	3.0A; 100V
366	U115B	3.0A; 200V
366	U115C	3.0A; 300V
366	U115D	3.0A; 400V
366	U115E	3.0A; 500V
366	U115F	3.0A; 50V
366	U115M	3.0A; 600V
		RECTIFIER STACK
368	UDA5	5.0KV
368	UDA7.5	7.5KV
368	UDA10	10.0KV
368	UDA15	15.0KV
368	UDB2.5	2.5KV
368	UDB5	5.0KV
368	UDB7.5	7.5KV
368	UDC5	5.0KV
368	UDC7.5	7.5KV
368	UDC10	10.0KV
368	UDC15	15.0KV

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER STACK
368	UDD2.5	2.5KV
368	UDD5	5.0KV
368	UDD7.5	7.5KV
368	UDE2.5	2.5KV
368	UDE5	5.0KV
368	UDF2.5	2.5KV
368	UDF5	5.0KV
		ZENER
372	UDZ110-UDZ140	Bidirectional; 3W; 5%
372	UDZ210-UDZ240	Bidirectional; 3W; 10%
372	UDZ707-UDZ790	Bidirectional; 3W; 5%
372	UDZ807-UDZ890	Bidirectional; 3W; 10%
372	UDZ5110-UDZ5140	Bidirectional; 5W; 5%
372	UDZ5210-UDZ5240	Bidirectional; 5W; 10%
372	UDZ5707-UDZ5790	Bidirectional; 5W; 5%
372	UDZ5807-UDZ5890	Bidirectional; 5W; 10%
372	UDZ7110	Bidirectional; 6W; 5%
372	UDZ7210	Bidirectional; 6W; 10%
372	UDZ7707-UDZ7760	Bidirectional; 6W; 5%
372	UDZ7807-UDZ7860	Bidirectional; 6W; 10%
372	UDZ8110-UDZ8120	Bidirectional; 1W; 5%
372	UDZ8210-UDZ8220	Bidirectional; 1W; 10%
372	UDZ8707-UDZ8791	Bidirectional; 1W; 5%
372	UDZ8807-UDZ8891	Bidirectional; 1W; 10%
		RECTIFIER
116	UES101 (1N5802)	2.5A; 50V
116	UES102 (1N5803)	2.5A; 75V
116	UES103 (1N5804)	2.5A; 100V
116	UES104 (1N5805)	2.5A; 125V
116	UES201 (1N5807)	6.0A; 50V
116	UES202 (1N5808)	6.0A; 75V
116	UES203 (1N5809)	6.0A; 100V
116	UES204 (1N5810)	6.0A; 125V
*	UES301	20.0A; 50V
*	UES302	20.0A; 75V
*	UES303	20.0A; 100V
*	UES304	20.0A; 125V
375	UES501	50.0A; 50V; DO-5
375	UES502	50.0A; 75V; DO-5
375	UES503	50.0A; 100V; DO-5
375	UES504	50.0A; 125V; DO-5
375	UES505	50.0A; 150V; DO-5
378	UES601	30A; 50V; TO-3
378	UES602	30A; 100V; TO-3
378	UES603	30A; 150V; TO-3
380	UES604	30A; 200V; TO-3
380	UES605	30A; 300V; TO-3
380	UES606	30A; 400V; TO-3
382	UES701	25A; 50V; DO-4
382	UES702	25A; 100V; DO-4
382	UES703	25A; 150V; DO-4
384	UES704	20A; 200V; DO-4
384	UES705	20A; 300V; DO-4
384	UES706	20A; 400V; DO-4
386	UES801	70A; 50V; DO-5
386	UES802	70A; 100V; DO-5
386	UES803	70A; 150V; DO-5
388	UES804	50A; 200V; DO-5
388	UES805	50A; 300V; DO-5
388	UES806	50A; 400V; DO-5
390	UES1101	2.5A; 50V
390	UES1102	2.5A; 100V
390	UES1103	2.5A; 150V
392	UES1104	2.0A; 200V
392	UES1105	2.0A; 300V
392	UES1106	2.0A; 400V

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER
394	UES1301	6A; 50V
394	UES1302	6A; 100V
394	UES1303	6A; 150V
396	UES1304	5.0A; 200V
396	UES1305	5.0A; 300V
396	UES1306	5.0A; 400V
		RECTIFIER, CENTERTAP
398	UES2601	30A; 50V
398	UES2602	30A; 100V;
398	UES2603	30A; 150V;
400	UES2604	30A; 200V; TO-3
400	UES2605	30A; 300V; TO-3
400	UES2606	30A; 400V; TO-3
		RECTIFIER STACK
402	UFB2.5	2.5KV
402	UFB5	5.0KV
402	UFB7.5	7.5KV
402	UFS5	5.0KV
402	UFS7.5	7.5KV
402	UFS10	10.0KV
405	UGB5	5.0KV
405	UGB7.5	7.5KV
405	UGB10	10.0KV
405	UGD5	5.0KV
405	UGD7.5	7.5KV
405	UGD10	10.0KV
405	UGE2.5	2.5KV
405	UGE5	5.0KV
405	UGE7.5	7.5KV
405	UGF2.5	2.5KV
405	UGF5	5.0KV
405	UGF7.5	7.5KV
		PIN DIODE
52	UM4000 series	0.5Ω, 3.0pF, 25W, 100-1200V
52	UM4300 series	1.5Ω, 2.2pF, 18W, 100-1000V
52	UM4900 series	0.5Ω, 3.0pF, 37W, 100-600V
52	UM6000 series	1.7Ω, 0.5pF, 6W, 100-1000V
52	UM6200 series	0.4Ω, 1.1pF, 6W, 100-400V
52	UM6600 series	2.5Ω, 0.4pF, 4W, 100-1000V
52	UM7000 series	1.0Ω, 0.9pF, 10W, 100-1600V
52	UM7100 series	0.6Ω, 1.2pF, 10W, 100-800V
52	UM7200 series	0.25Ω, 2.2pF, 10W, 100-400V
52	UM7300 series	3.5Ω, 0.7pF, 7.5W, 100-1000V
52	UM9301 series	CATV Attenuator Diodes
52	UM9401 series	2-Way Radio Switch Diodes
52	UM9415	2-Way Radio Switch Diodes
52	UM9441	Radiation Detector
52	UM9442	Radiation Detector
		TRANSISTOR
409	UMT1008	NPN, 8A; 300V; TO-3
409	UMT1009	NPN, 8A; 400V; TO-3
413	UMT1203	NPN; 3.0A; 300V; TO-220
413	UMT1204	NPN; 3.0A; 400V; TO-220
417	UMT3584	NPN; 2.0A; 250V; TO-220
417	UMT3585	NPN; 2.0A; 300V; TO-220
421	UPT011	NPN; 0.5A; 150V; TO-5
421	UPT012	NPN; 0.5A; 200V; TO-5
421	UPT013	NPN; 0.5A; 250V; TO-5
421	UPT014	NPN; 0.5A; 300V; TO-5
421	UPT015	NPN; 0.5A; 300V; TO-5
421	UPT021	NPN; 0.5A; 150V; TO-66
421	UPT022	NPN; 0.5A; 200V; TO-66
421	UPT023	NPN; 0.5A; 250V; TO-66

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		TRANSISTOR
421	UPT024	NPN; 0.5A; 300V; TO-66
421	UPT025	NPN; 0.5A; 300V; TO-66
423	UPT111	NPN; 1.0A; 40V; TO-5
423	UPT112	NPN; 1.0A; 60V; TO-5
423	UPT113	NPN; 1.0A; 80V; TO-5
423	UPT114	NPN; 1.0A; 100V; TO-5
423	UPT115	NPN; 1.0A; 100V; TO-5
425	UPT211	NPN; 2.0A; 40V; TO-5
425	UPT212	NPN; 2.0A; 60V; TO-5
425	UPT213	NPN; 2.0A; 80V; TO-5
425	UPT214	NPN; 2.0A; 100V; TO-5
425	UPT215	NPN; 2.0A; 100V; TO-5
425	UPT221	NPN; 2.0A; 40V; TO-66
425	UPT222	NPN; 2.0A; 60V; TO-66
425	UPT223	NPN; 2.0A; 80V; TO-66
425	UPT224	NPN; 2.0A; 100V; TO-66
425	UPT225	NPN; 2.0A; 100V; TO-66
427	UPT311	NPN; 2.0A; 150V; TO-5
427	UPT312	NPN; 2.0A; 200V; TO-5
427	UPT313	NPN; 2.0A; 250V; TO-5
427	UPT314	NPN; 2.0A; 300V; TO-5
427	UPT315	NPN; 2.0A; 300V; TO-5
427	UPT321	NPN; 2.0A; 150V; TO-66
427	UPT322	NPN; 2.0A; 200V; TO-66
427	UPT323	NPN; 2.0A; 250V; TO-66
427	UPT324	NPN; 2.0A; 300V; TO-66
427	UPT325	NPN; 2.0A; 300V; TO-66
429	UPT521	NPN; 3.5A; 150V; TO-66
429	UPT522	NPN; 3.5A; 200V; TO-66
429	UPT523	NPN; 3.5A; 250V; TO-66
429	UPT524	NPN; 3.5A; 300V; TO-66
429	UPT525	NPN; 3.0A; 300V; TO-66
429	UPT531	NPN; 3.0A; 150V; TO-3
429	UPT532	NPN; 3.0A; 200V; TO-3
429	UPT533	NPN; 3.0A; 250V; TO-3
429	UPT534	NPN; 3.0A; 300V; TO-3
429	UPT535	NPN; 3.0A; 300V; TO-3
431	UPT611	NPN; 5.0A; 40V; TO-5
431	UPT612	NPN; 5.0A; 60V; TO-5
431	UPT613	NPN; 5.0A; 80V; TO-5
431	UPT614	NPN; 5.0A; 100V; TO-5
431	UPT615	NPN; 5.0A; 100V; TO-5
431	UPT621	NPN; 5.0A; 40V; TO-66
431	UPT622	NPN; 5.0A; 60V; TO-66
431	UPT623	NPN; 5.0A; 80V; TO-66
431	UPT624	NPN; 5.0A; 100V; TO-66
431	UPT625	NPN; 5.0A; 100V; TO-66
433	UPT721	NPN; 5.0A; 150V; TO-66
433	UPT722	NPN; 5.0A; 200V; TO-66
433	UPT723	NPN; 5.0A; 250V; TO-66
433	UPT724	NPN; 5.0A; 300V; TO-66
433	UPT725	NPN; 5.0A; 300V; TO-66
433	UPT731	NPN; 5.0A; 150V; TO-3
433	UPT732	NPN; 5.0A; 200V; TO-3
433	UPT733	NPN; 5.0A; 250V; TO-3
433	UPT734	NPN; 5.0A; 300V; TO-3
433	UPT735	NPN; 5.0A; 300V; TO-3
435	UPT821	NPN; 10.0A; 40V; TO-66
435	UPT822	NPN; 10.0A; 60V; TO-66

PAGE	PART NUMBER	DESCRIPTION
		TRANSISTOR
435	UPT823	NPN; 10.0A; 80V; TO-66
435	UPT824	NPN; 10.0A; 100V; TO-66
435	UPT825	NPN; 10.0A; 100V; TO-66
435	UPT831	NPN; 10.0A; 40V; TO-3
435	UPT832	NPN; 10.0A; 60V; TO-3
435	UPT833	NPN; 10.0A; 80V; TO-3
435	UPT834	NPN; 10.0A; 100V; TO-3
435	UPT 835	NPN; 10.0A; 100V; TO-3
437	UPT931	NPN; 10.0A; 150V; TO-3
437	UPT932	NPN; 10.0A; 200V; TO-3
437	UPT933	NPN; 10.0A; 250V; TO-3
437	UPT934	NPN; 10.0A; 300V; TO-3
437	UPT935	NPN; 10.0A; 300V; TO-3
439	UPT1021	NPN; 15.0A; 40V; TO-66
439	UPT1022	NPN; 15.0A; 60V; TO-66
439	UPT1023	NPN; 15.0A; 80V; TO-66
439	UPT1024	NPN; 15.0A; 100V; TO-66
439	UPT1025	NPN; 15.0A; 100V; TO-66
439	UPT1031	NPN; 15.0A; 40V; TO-3
439	UPT1032	NPN; 15.0A; 60V; TO-3
439	UPT1033	NPN; 15.0A; 80V; TO-3
439	UPT1034	NPN; 15.0A; 100V; TO-3
439	UPT1035	NPN; 15.0A; 100V; TO-3
441	UPT1131	NPN; 20.0A; 40V; TO-3
441	UPT1132	NPN; 20.0A; 60V; TO-3
441	UPT1133	NPN; 20.0A; 80V; TO-3
441	UPT1134	NPN; 20.0A; 100V; TO-3
441	UPT1135	NPN; 20.0A; 100V; TO-3
443	UPTA510	NPN; 0.5A; 100V; TO-92
443	UPTA520	NPN; 0.5A; 200V; TO-92
443	UPTA530	NPN; 0.5A; 300V; TO-92
445	UPTB520	NPN; 0.1A; 200V; TO-92
445	UPTB530	NPN; 0.1A; 300V; TO-92
445	UPTB540	NPN; 0.1A; 400V; TO-92
445	UPTB550	NPN; 0.1A; 500V; TO-92
		RECTIFIER
447	UR105	2.0A; 50V
447	UR110	1.0A; 100V
447	UR115	1.0A; 150V
447	UR120	1.0A; 200V
447	UR125	1.0A; 250V
447	UR205	2.0A; 50V
447	UR210	2.0A; 100V
447	UR215	2.0A; 150V
447	UR220	2.0A; 200V
447	UR225	2.0A; 250V
*	UR710	1.0A; 100V
*	UR720	1.0A; 200V
		RECTIFIER STACK
450	US12	1.2KV
450	US15	1.5KV
450	US18	1.8KV
450	US20	2.0KV
450	US25	2.5KV
450	US30	3.0KV
450	US35	3.5KV
450	US40	4.0KV
450	US45A	4.5KV
450	US50A	5.0KV
450	US60A	6.0KV

*Contact Unitrode for specifications and ratings.

Legend: J — JAN JTX — JANTX JTXV — JANTXV

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER STACK
450	US70A	7.0KV
450	US80A	8.0KV
450	US100A	10.0KV
450	US120A	12.0KV
450	US150A	15.0KV
450	US180A	18.0KV
450	US200A	20.0KV
402	USB2.5	2.5KV
402	USB5	5.0KV
402	USB7.5	7.5KV
402	USB10	10.0KV
		SCHOTTKY RECTIFIER
454	USD520	75A; 20V; DO-5
454	USD535	75A; 35V; DO-5
454	USD545	75A; 45V; DO-5
		RECTIFIER STACK
450	USR12	1.2KV
450	USR15	1.5KV
*	USR18	1.8KV
450	USR20	2.0KV
450	USR25	2.5KV
450	USR30	3.0KV
450	USR35	3.5KV
450	USR40A	4.0KV
450	USR45A	4.5KV
450	USR50A	5.0KV
450	USR60A	6.0KV
450	USR70A	7.0KV
450	USR80A	8.0KV
450	USR100A	10.0KV
450	USR120A	12.0KV
450	USR150A	15.0KV
450	USR180A	18.0KV
402	USS5	5.0KV
402	USS7.5	7.5KV
402	USS10	10.0KV
402	USS15	15.0KV
		RECTIFIER
*	UT111(1N536)	0.75A; 50V
*	UT112 (1N537)	0.75A; 100V
*	UT113 (1N3656)	0.75A; 200V
*	UT114 (1N539)	0.75A; 300V
*	UT115 (1N3657)	0.75A; 400V
*	UT117 (1N547)	0.75A; 500V
*	UT118 (1N3658)	0.75A; 600V
*	UT119	0.75A; 800V
*	UT120	0.75A; 1000V
*	UT211 (1N645)	0.75A; 225V
*	UT212 (1N646)	0.75A; 300V
*	UT213 (1N647)	0.75A; 400V
*	UT214 (1N648)	0.75A; 500V
*	UT215 (1N649)	0.75A; 600V
*	UT221 (1N676)	0.5A; 100V
*	UT222 (1N677)	0.75A; 100V
*	UT223 (1N678)	0.5A; 200V
*	UT224 (1N679)	0.75A; 200V
*	UT225 (1N681)	0.5A; 300V
*	UT226 (1N682)	0.75A; 300V
*	UT227 (1N683)	0.5A; 400V
*	UT228 (1N684)	0.75A; 400V
*	UT229 (1N685)	0.5A; 500V
*	UT231 (1N686)	0.75A; 500V
*	UT232 (1N687)	0.5A; 600V
*	UT233 (1N689)	0.75A; 600V

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER
457	UT234	1.0A; 200V
457	UT235	1.0A; 400V
457	UT236	1.0A; 100V
457	UT237	1.0A; 500V
457	UT238	1.0A; 600V
457	UT242	1.25A; 200V
457	UT244	1.25A; 400V
457	UT245	1.25A; 500V
457	UT247	1.25A; 600V
457	UT249	1.25A; 100V
457	UT251	1.5A; 100V
457	UT252	1.5A; 200V
457	UT254	1.5A; 400V
457	UT255	1.5A; 500V
457	UT257	1.5A; 600V
457	UT258	1.5A; 800V
457	UT261	2.0A; 100V
457	UT262 (1N3981)	2.0A; 200V
457	UT264 (1N3982)	2.0A; 400V
457	UT265	2.0A; 500V
457	UT267 (1N3983)	2.0A; 600V
457	UT268	2.0A; 800V
457	UT347	1.0A; 1000V
457	UT361	1.0A; 800V
457	UT362	1.2A; 800V
457	UT363	1.2A; 1000V
457	UT364	1.5A; 1000V
461	UT2005	2.0A; 50V
461	UT2010	2.0A; 100V
461	UT2020	2.0A; 200V
461	UT2040	2.0A; 400V
461	UT2060	2.0A; 600V
*	UT2080	2.0A; 800V
461	UT3005	3.0A; 50V
461	UT3010	3.0A; 100V
461	UT3020	3.0A; 200V
461	UT3040	3.0A; 400V
461	UT3060	3.0A; 600V
*	UT3080	3.0A; 800V
461	UT4005	4.0A; 50V
461	UT4010 (1N5180)	4.0A; 100V
461	UT4020	4.0A; 200V
461	UT4040 (1N5207)	4.0A; 400V
461	UT4060	4.0A; 600V
*	UT4080	4.0A; 800V
*	UT4100	4.0A; 1000V
465	UT5105	7.5A; 50V
465	UT5110	7.5A; 100V
465	UT5120	7.5A; 200V
*	UT5130	7.5A; 300V
465	UT5140	7.5A; 400V
*	UT5150	7.5A; 600V
465	UT6105	9.0A; 50V
465	UT6110	9.0A; 100V
465	UT6120	9.0A; 200V
*	UT6130	9.0A; 300V
465	UT6140	9.0A; 400V
465	UT6160	9.0A; 600V
465	UT8105	12.0A; 50V
465	UT8110	12.0A; 100V
465	UT8120	12.0A; 200V
*	UT8130	12.0A; 300V
465	UT8140	12.0A; 400V
465	UT8160	12.0A; 600V
468	UTR01	1.0A; 50V
468	UTR02	2.0A; 50V

*Contact Unitrode for specifications and ratings.

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PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER
468	UTR10	0.5A; 100V
468	UTR11	1.0A; 100V
468	UTR12	2.0A; 100V
468	UTR20	0.5A; 200V
468	UTR21	1.0A; 200V
468	UTR22	2.0A; 200V
468	UTR30	0.5A; 300V
468	UTR31	1.0A; 300V
468	UTR32	2.0A; 300V
468	UTR40	0.5A; 400V
468	UTR41	1.0A; 400V
468	UTR42 (1N5206)	2.0A; 400V
468	UTR50	0.5A; 500V
468	UTR51	1.0A; 500V
468	UTR52	2.0A; 500V
468	UTR60	0.5A; 600V
468	UTR61	1.0A; 600V
468	UTR62	2.0A; 600V
*	UTR70	0.5A; 700V
*	UTR71	1.0A; 700V
472	UTR2305	2.0A; 50V
472	UTR2310	2.0A; 100V
472	UTR2320	2.0A; 200V
472	UTR2340	2.0A; 400V
472	UTR2350	2.0A; 500V
472	UTR2360	2.0A; 600V
472	UTR3305	3.0A; 50V
472	UTR3310	3.0A; 100V
472	UTR3320	3.0A; 200V
472	UTR3340	3.0A; 400V
472	UTR3350	3.0A; 500V
472	UTR3360	3.0A; 600V
472	UTR4305	4.0A; 50V
472	UTR4310	4.0A; 100V
472	UTR4320	4.0A; 200V
472	UTR4340	4.0A; 400V
472	UTR4350	4.0A; 500V
472	UTR4360	4.0A; 600V
476	UTR4405	6.0A; 50V
476	UTR4410	6.0A; 100V
476	UTR4420	6.0A; 200V
*	UTR4430	6.0A; 300V
476	UTR4440	6.0A; 400V
476	UTR5405	7.5A; 50V
476	UTR5410	7.5A; 100V
476	UTR5420	7.5A; 200V
*	UTR5430	7.5A; 300V
476	UTR5440	7.5A; 400V
476	UTR6405	9.0A; 50V
476	UTR6410	9.0A; 100V
476	UTR6420	9.0A; 200V
*	UTR6430	9.0A; 300V
476	UTR6440	9.0A; 400V
479	UTX105	1.0A; 50V
479	UTX110	1.0A; 100V
479	UTX115	1.0A; 150V
479	UTX120	1.0A; 200V
479	UTX125	1.0A; 250V
479	UTX205	2.0A; 50V
479	UTX210	2.0A; 100V
479	UTX215	2.0A; 150V
479	UTX220	2.0A; 200V
479	UTX225	2.0A; 250V
482	UTX3105	3.0A; 50V
482	UTX3110	3.0A; 100V
482	UTX3115	3.0A; 150V

PAGE	PART NUMBER	DESCRIPTION
		RECTIFIER
482	UTX3120	3.0A; 200V
*	UTX3125	3.0A; 250V
482	UTX4105	4.0A; 50V
482	UTX4110	4.0A; 100V
482	UTX4115	4.0A; 150V
482	UTX4120	4.0A; 200V
*	UTX4125	4.0A; 250V
		ZENER
485	UZ110-UZ119	3W; 5%
485	UZ120-UZ140	3W; 5%
485	UZ210-UZ219	3W; 10%
485	UZ220-UZ240	3W; 10%
485	UZ706-UZ760	3W; 5%
485	UZ770-UZ790	3W; 5%
485	UZ806-UZ860	3W; 10%
485	UZ870-UZ890	3W; 10%
487	UZ4110-UZ4120	5W; 5%
487	UZ4210-UZ4220	5W; 10%
487	UZ4706-UZ4791	5W; 5%
487	UZ4806-UZ4891	5W; 10%
489	UZ5110-UZ5119	5W; 5%
489	UZ5120-UZ5240	5W; 5%
489	UZ5210-UZ5240	5W; 10%
489	UZ5310-UZ5340	5W; 20%
489	UZ5706-UZ5760	5W; 5%
489	UZ5770-UZ5790	5W; 5%
489	UZ5806-UZ5860	5W; 10%
489	UZ5870-UZ5890	5W; 10%
489	UZ5906-UZ5960	5W; 20%
489	UZ5970-UZ5990	5W; 20%
491	UZ7110	10W; 5%
491	UZ7110L	6W; 5%
491	UZ7210	10W; 10%
491	UZ7210L	6W; 10%
491	UZ7706-UZ7750	10W; 5%
491	UZ7706L-UZ7750L	6W; 5%
491	UZ7756-UZ7790	10W; 5%
491	UZ7756L-UZ7790L	6W; 5%
491	UZ7806-UZ7850	10W; 10%
491	UZ7806L-UZ7850L	6W; 10%
491	UZ7851-UZ7890	10W; 10%
491	UZ7851L-UZ7890L	6W; 10%
493	UZ8110-UZ8120	1W; 5%
493	UZ8210-UZ8220	1W; 10%
493	UZ8706-UZ8790	1W; 5%
493	UZ8806-UZ8890	1W; 10%
		TRANSIENT SUPPRESSOR
495	UZS306-UZS440	3W; 5%
495	UZS506-UZS640	3W; 10%

*Contact Unitrode for specifications and ratings.

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III. PRODUCT SELECTION GUIDE

HOW TO USE THIS SECTION

The Product Selection Guide has been designed to give you a perspective of our capabilities on each product line and more specifically to provide you with a simple method for selecting particular parts for your applications.

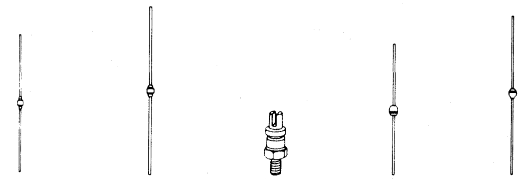
The selection guide for each market or product line is organized so that you can easily determine which products meet your current or power and voltage requirements. From there you can select products as to package preference and other major performance requirements.

For the final decision in the process of product selection, after limiting your choice to a few part numbers, it is necessary to refer to the data sheets in the next section of the catalogue. Generally speaking, to find the appropriate data sheet you can by-pass the Part Number Index and go directly to the Product Data Sheet Section because the data sheets are in numeric-alphabetic order, (1N-followed by 2N-followed by numeric house numbers, followed by alphabetic part numbers.)

When you are interested in determining if Unitrode makes a particular part number or in identifying known part numbers and their major characteristics, we suggest that you utilize the Part Number Index **not** the Product Selection Guide.

PRODUCT SELECTION GUIDES (in order of appearance)

RECTIFIERS

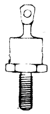


A B C D E

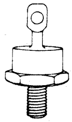
STANDARD RECOVERY

Average D.C. Output Current		1A	1A	2A	3A	3A	4A	7.5A	9A	12A	35A
Package Style		**A**	**D**	**A**	**E**	**B**	**B**	**C**	**C**	**C**	**DO-5**
PEAK INVERSE VOLTAGE	50V	†UR105	U14F	UR205	U15F	UT3005	UT4005	UT5105	UT6105	UT8105	
	75V										
	100V	UT236 †UR110	U14A	UT261 †UR210	U15A	UT3010	UT4010	UT5110	UT6110	UT8110	1N1184**
	125V										
	150V	†UR115		†UR215							
	200V	UT234 †UR120 1N4245* 1N5614*	U14B	UT262 †UR220 1N3611**	U15B	UT3020	UT4020 1N5550*	UT5120	UT6120	UT8120	1N1186**
	250V	†UR125		†UR225							
	300V										
	400V	UT235 1N4246* 1N5616*	U14D	UT264 1N3612**	U15D	UT3040	UT4040 1N5551*	UT5140	UT6140	UT8140	1N1188**
	600V	UT238 1N4247* 1N5618*	U14M	UT267 1N3613**	U15M	UT3060	UT4060 1N5552*	UT5160	UT6160	UT8160	
	800V	UT361 1N4248* 1N5620*	U14N	UT268 1N3614**	U15N		1N5553*				
	1000V	UT347 1N4249*	U14P	UT364							

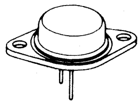
* Available as JAN, JANTX, JANTXV.
** Available as JAN, JANTX.
† Radiation Tolerant



DO-4



DO-5



TO-3

FAST RECOVERY

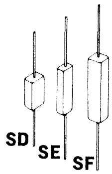
Average D.C. Output Current	1A	1A	2A	2.5A	3A	3A	4A	5A-6A	6.5A-9A	20-25A	30A		50A-70A
Package Style	**A**	**D**	**A**	**A**	**B**	**E**	**B**	**B**	**C**	**DO-4**	**TO-3**	**DO-5**	**DO-5**
PEAK INVERSE VOLTAGE 20V													USD520(1)
35V													USD535(1)
45V													SD51(1) USD545(1)
50V	UTR01 UTX105	U114F	UTR02 UTX205	1N5802* UES1101	UTR3305 UTX3105 1N5415*	U115F	UTR4305 UTX4105	1N5807* UES1301	UTR4405 UTR5405 UTR6405	1N5812* UES5701	UES601	1N3909**	UES501 UES801
75V				1N5803				1N5808		1N5813			UES502
100V	UTR11 UTX110	U114A	UTR12 UTX210	1N5804* UES1102	UTR3310 UTX3310 1N5186** 1N5416*	U115A	UTR4310 UTX4110	1N5809* UES1302	UTR4410 UTR5410 UTR6410	1N5814* UES702	UES602	1N3910**	UES503 UES802
125V				1N5805				1N5810		1N5815			UES504
150V				1N5806* UES1103	UTX3115		UTX4115	1N5811* UES1303		1N5816* UES703	UES603		UES505 UES803
200V	UTR21 UTX120 1N4942* 1N5615*	U114B	UTR22 UTX220 UES1104		UTR3320 UTX3120 1N5187** 1N5417*	U115B	UTR4320 UTX4120	UES1304	UTR4420 UTR5420 UTR6420	UES704	UES604	1N3911**	UES804
250V	UTX125		UTX225										
300V	UTR31	U114C	UTR32 UES1105			U115C		UES1305		UES705	UES605	1N3912**	UES805
400V	UTR41 1N4944* 1N5617*	U114D	UTR42 UES1106		UTR3340 1N5188** 1N5418*	U115D	UTR4340	UES1306	UTR4440 UTR5440 UTR6440	UES706	UES606	1N3913**	UES806
500V		U114E				U115E							
600V	UTR61 1N4946* 1N5619*	U114M	UTR62		UTR3360 1N5190** 1N5420*	U115M	UTR4360						
800V		U114N											
1000V													
Reverse Recovery Time (max.)	75-250 ns	200ns	50-250 ns	25ns	100-400 ns	200ns	100-400 ns	30-50 ns	300-500 ns	35-50 ns	50ns	200 ns	50ns

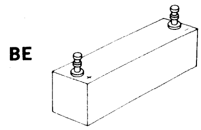
* Available as JAN, JANTX, JANTXV.
** Available as JAN, JANTX.
(1) Schottky

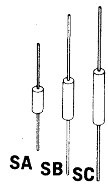
RECTIFIER ASSEMBLIES

High Voltage Stacks and Modules

STANDARD RECOVERY

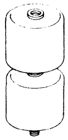






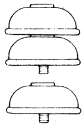
Peak Inverse Voltage	AVERAGE D.C. OUTPUT CURRENT											
	≤.25A	.25—.5A	.5—.75A	.75—1A	1—1.5A	1.5—2A	2—2.5A	2.5—3A	3—4A	4—5A	5—6A	6—7A
1.2kV					US12 **SA**							
1.5kV				US15 **SA**								
1.8kV			US18 **SA**									
2.0kV			US20 **SA**									
2.5kV			US25 **SB**		USB2.5 **DH**			UDB2.5 **DD**			UDE2.5 **DD**	UGE2.5 **DG**
3.0kV			US30 **SB**									
3.5kV		US35 **SC**										
4.0kV		US40 **SC**										
4.5kV		US45A **SD**										
5.0kV		US50A **SD**	USB5 USS5 **DH**			UDA5 UDB5 **DD** 1N5600* **DE**				UGB5 **DG** UDE5 **DD**	UGE5 **DG** 1N5603* **DF**	
6.0kV		US60A **SD**										
7.0kV		US70A **SD**										
7.5kV		USS7.5 **DH**	USB7.5 **DH**		UDA7.5 UDB7.5 **DD**			UGB7.5 **DG**	UGE7.5 **DG**			
8.0kV	US80A **SE**											
10kV	US100A **SE**	USB10 USS10 **DH**	688-10 **BE**	UDA10 **DD** 1N5597* **DE**			UGB10 **DG**					
12kV	US120A **SE**	688-12 **BE**										
15kV	US150A **SF**	USS15 **DH** 688-15 **BE**	UDA15 **DD**									
18kV	US180A **SF**	688-18 **BE**										
20kV	688-20 **BE** US200A **SF**											
25kV	688-25 **BE**											

* Available as JAN.

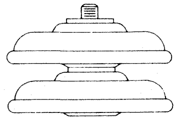


DH

FAST RECOVERY



DD, DE



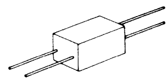
DF, DG

III PRODUCT SELECTION GUIDE

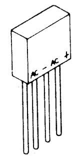
Peak Inverse Voltage	AVERAGE D.C. OUTPUT CURRENT									
	≤.25A	.25—.5A	.5—.75A	.75—1A	1—1.5A	1.5—2A	2—2.5A	2.5—4A	4—5A	5—6A
1.2kV					USR12 **SA**					
1.5kV				USR15 **SA**						
1.8kV			USR18 **SA**							
2.0kV			USR20 **SB**							
2.5kV		USR25 **SB**		UFB2.5 **DH**			UDD2.5 **DD**		UDF2.5 **DD**	UGF2.5 **DG**
3.0kV		USR30 **SC**								
3.5kV		USR35 **SC**								
4.0kV		USR40A **SD**								
4.5kV		USR45A **SD**								
5.0kV	USR50A **SD**		UFB5 UFS5 **DH**		UDC5 UDD5 **DD**			UGD5 UGF5 **DG** UDF5 **DD**		
6.0kV	USR60A **SD**									
7.0kV	USR70A **SE**									
7.5kV		UFB7.5 UFS7.5 **DH**		UDC7.5 UDD7.5 **DD**			UGF7.5 **DG**			
8.0kV	USR80A **SE**									
10kV	USR100A **SE**	UFS10 **DH**	688-10R **BE** UDC10 **DD**			UGD10 **DG**				
12kV	USR120A **SF**	688-12R **BE**								
15kV	USR150A **SF**	UDC15 **DD** 688-15R **BE**								
18kV	USR180A **SF**	688-18R **BE**								
20kV	688-20R **BE**									
25kV	688-20R **BE**									
Reverse Recovery Time (max.)	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns	500ns

RECTIFIER ASSEMBLIES

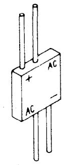
Single Phase Full-Wave Bridges



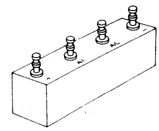
HJ,HK,HL,HM,HN,HO,HP



S



G,GA,GH



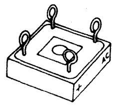
BS

STANDARD RECOVERY

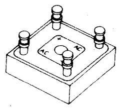
Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT					
	≤.25A	.25—.75A	.75—1.5A	1.5—2.5A	5—10A	10—25A
100V			673-1 **G or S**	697-1 **GA**	680-1 **NA**	679-1 **NB** SPA-25* **MC**
200V			673-2 **G or S**	697-2 **GA**	680-2 **NA** 469-1** **MD**	679-2 **NB** SPB-25* **MC**
300V			673-3 **G or S**	697-3 **GA**	680-3 **NA**	679-3 **NB**
400V			673-4 **G or S**	697-4 **GA**	680-4 **NA** 469-2** **MD**	679-4 **NB** SPC-25* **MC**
500V			673-5 **G or S**	697-5 **GA**	680-5 **NA**	679-5 **NB**
600V			673-6 **G or S**	697-6 **GA**	680-6 **NA** 469-3** **MD**	679-6 **NB** SPD-25* **MC**
1.2kV		673-7 **GH**				
1.8kV		673-75 **HJ**				
2.4kV		673-8 **HK**				
2.5kV			686-2.5 **BS**			
3.0kV		673-85 **HL**	686-3 **BS**			
3.6kV	673-9 **HM**					
4.0kV			686-4 **BS**			
4.2kV	673-10 **HN**					
4.8kV	673-11 **HO**					
5.0kV	673-12 **HO**	686-5 **BS**				
7.0kV		686-7 **BS**				

* Available as JAN.

** Available as JAN, JANTX.



NA, NB



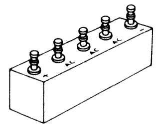
MA, MB, MC, MD

FAST RECOVERY

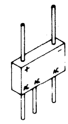
Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT							
	≤.25A	.25—.75A	.75—1.5A	1.5—2.5A	5—10A	10—25A		25—35A
50V							803-1 **MB**	802-1 **MA**
100V			676-1 **G or S**	698-1 **GA**	684-1 **NA**	683-1 **NB**	803-2 **MB**	802-2 **MA**
125V							803-3 **MB**	802-3 **MA**
150V							803-4 **MB**	802-4 **MA**
200V			676-2 **G or S**	698-2 **GA**	684-2 **NA**	683-2 **NB**		
300V			676-3 **G or S**	698-3 **GA**	684-3 **NA**	683-3 **NB**		
400V			676-4 **G or S**	698-4 **GA**	684-4 **NA**	683-4 **NB**		
500V			676-5 **G or S**	698-5 **GA**	684-5 **NA**	683-5 **NB**		
600V			676-6 **G or S**	698-6 **GA**	684-6 **NA**	683-6 **NB**		
1.2kV		676-12 **HJ**						
1.8kV		676-18 **HK**						
2.4kV		676-24 **HL**						
2.5kV			686-25R **BS**					
3.0kV		676-30 **HM**	686-3R **BS**					
3.6kV	676-36 **HN**							
4.0kV			686-4R **BS**					
4.2kV	676-42 **HO**							
4.8kV	676-48 **HP**							
5.0kV	676-50 **HP**	686-5R **BS**						
7.0kV		686-7R **BS**						
Reverse Recovery Time (max.)	500ns	500ns	500ns	500ns	500ns	500ns	50ns	50ns

RECTIFIER ASSEMBLIES

Three Phase Full-Wave Bridges



BT



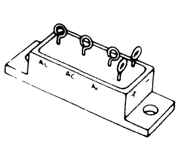
F

STANDARD RECOVERY

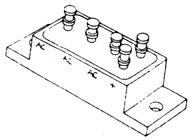
Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT				
	.25—1A	1—2.5A	4.5—15A	15—25A	
50V					
100V		700-1 **F**	695-1 **NC**	678-1 **NC**	
125V					
150V					
200V		700-2 **F**	695-2 **NC**	678-2 **NC**	483-1* **ME**
300V		700-3 **F**	695-3 **NC**	678-3 **NC**	
400V		700-4 **F**	695-4 **NC**	678-4 **NC**	483-2* **ME**
500V		700-5 **F**	695-5 **NC**	678-5 **NC**	
600V		700-6 **F**	695-6 **NC**	678-6 **NC**	483-3* **ME**
2.5kV	685-2.5 **BT**				
3.0kV	685-3 **BT**				
4.0kV	685-4 **BT**				
5.0kV	685-5 **BT**				
7.0kV	685-7 **BT**				

* Available as JAN

III PRODUCT SELECTION GUIDE



NC



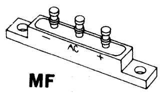
ME

FAST RECOVERY

Peak Inverse Voltage Per Leg	AVERAGE D.C. OUTPUT CURRENT					
	.25—1A	1—2.5A	4.5—15A	15—25A		25—40A
50V					801-1 **ME**	800-1 **ME**
100V		701-1 **F**	696-1 **NC**	682-1 **NC**	801-2 **ME**	800-2 **ME**
125V					801-3 **ME**	800-3 **ME**
150V					801-4 **ME**	800-4 **ME**
200V		701-2 **F**	696-2 **NC**	682-2 **NC**		
300V		701-3 **F**	696-3 **NC**	682-3 **NC**		
400V		701-4 **F**	696-4 **NC**	682-4 **NC**		
500V		701-5 **F**	696-5 **NC**	682-5 **NC**		
600V		701-6 **F**	696-6 **NC**	682-6 **NC**		
2.5kV	685-2.5R **BT**					
3.0kV	685-3R **BT**					
4.0kV	685-4R **BT**					
5.0kV	685-5R **BT**					
7.0kV	685-7R **BT**					
Reverse Recovery Time (max.)	500ns	500ns	500ns	500ns	50ns	50ns

RECTIFIER ASSEMBLIES

Doublers and Center Tap Rectifiers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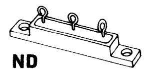
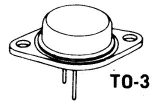
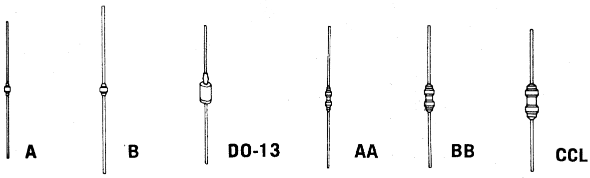

ND


TO-3

Peak Inverse Voltage Per Leg	STANDARD RECOVERY	FAST RECOVERY	HIGH EFFICIENCY	
	AVERAGE D.C. OUTPUT CURRENT	AVERAGE D.C. OUTPUT CURRENT	AVERAGE D.C. OUTPUT CURRENT	
	1—15A	1—15A	15—20A	30A
50V			804-1 **MF**	UES2601 **TO-3**
100V	681-1 **ND**	689-1 **ND**	804-2 **MF**	UES2602 **TO-3**
125V			804-3 **MF**	
150V			804-4 **MF**	UES2603 **TO-3**
200V	681-2 **ND**	689-2 **ND**		UES2604 **TO-3**
300V	681-3 **ND**	689-3 **ND**		UES2605 **TO-3**
400V	681-4 **ND**	689-4 **ND**		UES2606 **TO-3**
500V	681-5 **ND**	689-5 **ND**		
600V	681-6 **ND**	689-6 **ND**		
Reverse Recovery Time (max.)		500ns	50ns	35-50ns

POWER ZENERS AND TRANSIENT VOLTAGE SUPPRESSORS



TRANSIENT VOLTAGE SUPPRESSORS †

Type	Minimum V_Z (V)	Surge I_{PP} (A)	Maximum V_Z @ I_{PP} (V)
Package Style	**DO-13**		
1N5555*	33.0	32	47.5
1N5556*	43.7	24	63.5
1N5557*	54.0	19	79.5
1N5558	191.0	5.7	265
Package Style	**CCL**		
1N5610*	33.0	32	47.5
1N5611*	43.7	24	63.5
1N5612*	54.0	19	79.5
1N5613*	191.0	5.7	265

* Available as JAN & JANTX. † 1500W for 1msec.

BI-DIRECTIONAL ZENERS

Power	1W	3W	5W	6W
Package Style	**AA**		**BB**	**CCL**
VOLTAGE, V_Z (10% Tolerance)				
7.5	UDZ8807	UDZ807	UDZ5807	UDZ7807
8.2	UDZ8808	UDZ808	UDZ5808	UDZ7808
9.1	UDZ8809	UDZ809	UDZ5809	UDZ7809
10	UDZ8810	UDZ810	UDZ5810	UDZ7810
12	UDZ8812	UDZ812	UDZ5812	UDZ7812
15	UDZ8815	UDZ815	UDZ5815	UDZ7815
18	UDZ8818	UDZ818	UDZ5818	UDZ7818
20	UDZ8820	UDZ820	UDZ5820	UDZ7820
24	UDZ8824	UDZ824	UDZ5824	UDZ7824
27	UDZ8827	UDZ827	UDZ5827	UDZ7827
30	UDZ8830	UDZ830	UDZ5830	UDZ7830
33	UDZ8833	UDZ833	UDZ5833	UDZ7833
36	UDZ8836	UDZ836	UDZ5836	UDZ7836
40	UDZ8840	UDZ840	UDZ5840	UDZ7840
45	UDZ8845	UDZ845	UDZ5845	UDZ7845
60	UDZ8860	UDZ860	UDZ5860	UDZ7860
300		UDZ230	UDZ5230	
220		UDZ222	UDZ5222	
100		UDZ210	UDZ5210	UDZ7210

ZENER/TRANSIENT VOLTAGE SUPPRESSORS

Type	ZENER RATINGS*		TVS Ratings**	
	Nominal Zener Voltage V_Z @ I_{ZT}	Test Current I_{ZT}	Typical Peak Pulse Current I_{PP}	Typical Peak Clamping Voltage V_C
	Volts	mA	Amps	Volts
Package Style	**A**			
UZS306	6.8	75	17	8.7
UZS307	7.5	75	15	9.8
UZS308	8.2	75	13	11.2
UZS309	9.1	75	12	12.7
UZS310	10.0	75	10	14.0
UZS312	12	65	8.9	16.8
UZS313	13	50	8.2	18.2
UZS314	14	50	7.6	19.6
UZS315	15	50	7.1	21.0
UZS316	16	50	6.7	22.4
UZS318	18	40	5.9	25
UZS320	20	40	5.4	28
UZS322	22	30	4.9	31
UZS324	24	30	4.5	34
UZS327	27	25	3.9	38
UZS330	30	25	3.6	42
UZS333	33	20	3.2	46
UZS336	36	20	3.0	50
UZS339	39	20	2.7	55
UZS343	43	15	2.5	61
UZS347	47	15	2.3	65
UZS351	51	15	2.1	71
UZS356	56	10	1.9	78
UZS375	75	10	1.4	105
UZS410	100	5.0	1.1	140
UZS420	200	4.0	0.55	275
UZS426	260	3.0	0.42	355
UZS428	280	3.0	0.39	380
UZS440	400	2.0	0.28	545

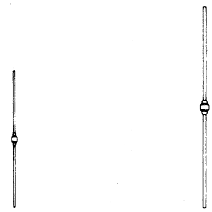
† ±5% Tolerance
* 3W continuous power
** 150W peak pulse power (1 millisecond)

TRANSIENT VOLTAGE SUPPRESSORS §
for Microprocessors and Integrated Circuits

Type	Application Voltage	BV (min) @ 1 mA	Surge I_{PP}	Max V_C @ I_{PP}
Package Style	**B**			
TVS 505	5.0V	6.0V	53.7A	9.3V
TVS 510	10.0	11.1	30.3	16.5
TVS 512	12.0	13.8	23.8	21.0
TVS 515	15.0	16.7	19.8	25.2
TVS 518	18.0	20.4	16.3	30.5
TVS 524	24.0	28.4	11.9	42.0
TVS 528	28.0	30.7	10.7	46.5

§ Package Rating: 500W Peak Pulse Power for 1 mSec duration

POWER ZENERS AND TRANSIENT VOLTAGE SUPPRESSORS



A B

	Power	1W	1.5W	3W	5W	5W	6W	10W
	Package Style	A	A‡	A‡	B	B‡	CL‡	C‡
VOLTAGE V_Z (5% Tolerance)†	6.8V	UZ8706	1N4461*	1N5063	UZ4706	1N4954*	UZ7706L	UZ7706
	7.5V	UZ8707	1N4462*	1N5064	UZ4707	1N4955*	UZ7707L	UZ7707
	8.2V	UZ8708	1N4463*	1N5065	UZ4708	1N4956*	UZ7708L	UZ7708
	9.1V	UZ8709	1N4464*	1N5066	UZ4709	1N4957*	UZ7709L	UZ7709
	10V	UZ8710	1N4465*	1N5067	UZ4710	1N4958*	UZ7710L	UZ7710
	11V	UZ8711	1N4466*	1N5068		1N4959*	UZ7711L	UZ7711
	12V	UZ8712	1N4467*	1N4883	UZ4712	1N4960*	UZ7712L	UZ7712
	13V	UZ8713	1N4468*	1N5069	UZ4713	1N4961*	UZ7713L	UZ7713
	14V	UZ8714		1N5070		1N5118	UZ7714L	UZ7714
	15V	UZ8715	1N4469*	1N5071	UZ4715	1N4962*	UZ7715L	UZ7715
	16V	UZ8716	1N4470*	1N5072	UZ4716	1N4963*	UZ7716L	UZ7716
	18V	UZ8718	1N4471*	1N5073	UZ4718	1N4964*	UZ7718L	UZ7718
	20V	UZ8720	1N4472*	1N4884	UZ4720	1N4965*	UZ7720L	UZ7720
	22V	UZ8722	1N4473*	1N5074	UZ4722	1N4966*	UZ7722L	UZ7722
	24V	UZ8724	1N4474*	1N5075	UZ4724	1N4967*	UZ7724L	UZ7724
	27V	UZ8727	1N4475*	1N5076	UZ4727	1N4968*	UZ7727L	UZ7727
	30V	UZ8730	1N4476*	1N5077	UZ4730	1N4969*	UZ7730L	UZ7730
	33V	UZ8733	1N4477*	1N5078	UZ4733	1N4970*	UZ7733L	UZ7733
	36V	UZ8736	1N4478*	1N5079	UZ4736	1N4971*	UZ7736L	UZ7736
	39V		1N4479*	1N5080	UZ4739	1N4972*		
	40V	UZ8740		1N5081		1N5119	UZ7740L	UZ7740
	43V		1N4480*	1N5082	UZ4743	1N4973*		
	45V	UZ8745		1N5083		1N5120	UZ7745L	UZ7745
	47V		1N4481*	1N5084	UZ4747	1N4974*		
	50V	UZ8750		1N5085		1N5121	UZ7750L	UZ7750
	51V		1N4482*	1N5086	UZ4751	1N4975*		
	56V	UZ8756	1N4483*	1N5087	UZ4756	1N4976*	UZ7756L	UZ7756
	60V	UZ8760		1N5088		1N5122	UZ7760L	UZ7760
	62V		1N4484	1N5089	UZ4762	1N4977*		
	68V		1N4485	1N5090	UZ4768	1N4978*		
	PULSE POWER **	100W	140W	230W	720W	900W	2000W	2000W

* Available as JAN, JANTX, & JANTXV
** For 100 μsec pulse width
‡ Unitrode fused-in-glass construction
† 10% and 20% tolerance also available.

CL

C

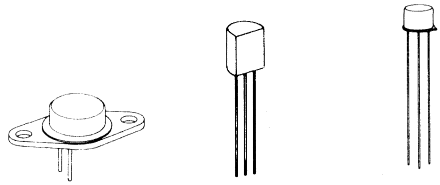
VOLTAGE V_Z (5% Tolerance)†

Power	1W	1.5W	3W	5W	5W	6W	10W
Package Style	**A**	**A‡**	**A‡**	**B**	**B‡**	**CL‡**	**C‡**
70V	UZ8770		1N5091		1N5123	UZ7770L	UZ7770
75V	UZ8775	1N4486	1N5092	UZ4775	1N4979*	UZ7775L	UZ7775
80V	UZ8780		1N5093		1N5124	UZ7780L	UZ7780
82V		1N4487	1N5094	UZ4782	1N4980*		
90V	UZ8790		1N4096		1N5125	UZ7790L	UZ7790
91V		1N4488	1N4095	UZ4791	1N4981*		
100V	UZ8110	1N4489	1N4097	UZ4110	1N4982*	UZ7110L	UZ7110
110V	UZ8111		1N5096	UZ4111	1N4983*		
120V	UZ8112		1N5097	UZ4112	1N4984*		
130V	UZ8113		1N5098	UZ4113	1N4985*		
140V	UZ8114		1N5099				
150V	UZ8115		1N4098	UZ4115	1N4986*		
160V	UZ8116		1N5100	UZ4116	1N4987*		
170V	UZ8117		1N5101		1N5127		
180V	UZ8118		1N5102	UZ4118	1N4988*		
190V	UZ8119		1N5103		1N5128		
200V	UZ8120		1N5104	UZ4120	1N4989*		
220V			1N5105		1N4990*		
240V			1N5106		1N4991*		
260V			1N5107		1N5129		
270V			1N5108		1N4992*		
280V			1N5109		1N5130		
300V			1N5110		1N4993*		
320V			1N5111		1N5131		
330V			1N5112		1N4994*		
340V			1N5113		1N5132		
360V			1N5114		1N4995*		
380V			1N5115		1N5133		
390V			1N5116		1N4996*		
400V			1N5117		1N5134		
PULSE POWER **	100W	140W	230W	720W	900W	2000W	2000W

* Available as JAN, JANTX, & JANTXV
** For 100 μsec pulse width
‡ Unitrode fused-in-glass construction
† 10% and 20% tolerance also available.

NPN POWER SWITCHING TRANSISTORS

.1-20A, 50-500V, $f_T = 20-80MH_z$



TO-66 TO-92 TO-5

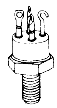
LOW VOLTAGE

Maximum Collector Current		1 AMP (PEAK)	2 AMP		3 AMP		5 AMP	
Package Style		**TO-92**	**TO-5**	**TO-66**	**TO-5**		**Pancake TO-5**	
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\,(SUS)}$	50V							
	60V		UPT212	UPT222	2N3418*	2N3420*	2N2855	2N2854
	80V		UPT213	UPT223	2N3419*	2N3421*	2N2850	2N5487
	90V							
	100V	UPTA510	UPT214 UPT215	UPT224 UPT225			2N5488	
h_{FE} Minimum		25 @ .1A	30 @ .5A		20 @ 1A	40 @ 1A	40 @ 1A	100 @ 1A
V_{CE} (sat) Max.		1V @ .5A	1V @ 2A		.5V @ 2A	.5V @ 2A	.25V @ 1A	
t_f Maximum		0.2μs (typical)	0.1μs (typical)		1.2μs ($t_{OFF} = t_s + t_f$)		0.15μs (2N2855) 0.25μs (2N5488)	0.15μs (2N2854) 0.2μs (2N5487)

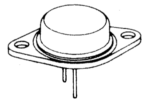
HIGH VOLTAGE

Maximum Collector Current		.5 AMP (PEAK)	.5 AMP	1 AMP (PEAK)	2 AMP	
Package Style		**TO-92**	**TO-5**	**TO-92**	**TO-5**	
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\,(SUS)}$	150V		UPTO11		UPT311	
	175V					
	200V	UPTB520	UPTO12	UPTA520	UPT312	2N5662*
	250V		UPTO13		UPT313	
	300V	UPTB530	UPTO14 UPTO15	UPTA530	UPT314 UPT315	2N5663*
	400V	UPTB540				
	500V	UPTB550				
h_{FE} Minimum		20 @ 25mA	30 @ .1A	25 @ .1A	30 @ .5A	40 @ .5A (2N5662) 25 @ .5A (2N5663)
V_{CE} (sat) Max.		1.2v @ 50mA	1V @ .5A	1V @ .5A	1V @ 2A	.4V @ 1A
t_f Maximum		1.0μs (typical)	0.2μs (typical)		0.3μs (typical)	0.4μs (2N5662) 0.6μs (2N5663)

* Available as JAN, JANTX, JANTXV.

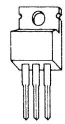


TO-111

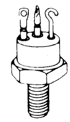


TO-3

Pancake
TO-5



TO-220



TO-59

LOW VOLTAGE

Maximum Collector Current		5 AMP					
Package Style		**TO-5**	**TO-66**	**TO-59**		**TO-111**	
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\ (SUS)}$	50V						
	60V	UPT612	UPT622				
	80V	UPT613	UPT623	2N2151** 2N2880* 2N3998*	2N3999*	2N3749* 2N3996*	2N3997*
	90V						
	100V	UPT614 UPT615	UPT624 UPT625				
h_{FE} Minimum		30 @ 1A		40 @ 1A	80 @ 1A	40 @ 1A	80 @ 1A
V_{CE} (sat) Max.		1V @ 5A		.25V @ 1A (1V @ 1A for 2N2151)			
t_f Maximum		0.1μs (typical)		0.3μs (2N2880) / 0.8μs (2N3998)	1.0μs	0.3μs (2N3749) / 0.8μs (2N3996)	1.0μs

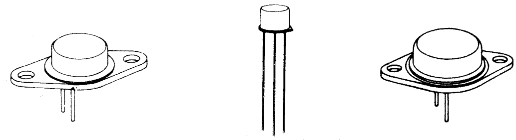
HIGH VOLTAGE

Maximum Collector Current		2 AMP			3 AMP		
Package Style		**TO-66**		**TO-220**	**TO-66**	**TO-3**	**TO220**
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\ (SUS)}$	150V	UPT321			UPT521	UPT531	
	175V						
	200V	UPT322	2N5660*		UPT522	UPT532	
	250V	UPT323		UMT3584	UPT523	UPT533	
	300V	UPT324 UPT325	2N5661*	UMT3585	UPT524 UPT525	UPT534 UPT535	UMT1203
	400V						UMT1204
	500V						
h_{FE} Minimum		30 @ .5A	40 @ .5A (2N5660) / 25 @ .5A (2N5661)	25 @ 1A	25 @ 1A		7 @ 2A
V_{CE} (sat) Max.		1V @ 2A	.4V @ 1A	0.75V @ 1A	1V @ 3A		3V @ 3A
t_f Maximum		0.3μs (typical)	0.4μs (2N5660) / 0.6μs (2N5661)	3.0μs	0.4μs (typical)		0.7μs

* Available as JAN, JANTX, JANTXV.
** Available as JAN, JANTX.

NPN POWER SWITCHING TRANSISTORS

.1-20A, 50-500V, $f_T = 20-80MHz$



TO-66 TO-5 TO-3

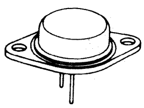
LOW VOLTAGE

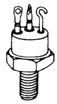
Maximum Collector Current		10 AMP					
Package Style		**TO-5**			**TO-66**	**TO-3**	
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO (SUS)}$	60V				UPT822	UPT832	
	70V		2N4150**				
	75V						
	80V			2N5552	UPT823	UPT833	
	90V						
	100V	2N6232			UPT824 UPT825	UPT834 UPT835	
	120V					20 @ 10A	2N6354
h_{FE} Minimum		25 @ 5A	50 @ 5A	50 @ 5A	20 @ 10A		10 @ 10A
V_{CE} (sat) Max.		0.7V @ 5A	0.6V @ 5A	0.5V @ 5A	1V @ 10A	1V @ 10A	1.0 @ 10A
t_f Maximum		0.8μs	0.5μs	0.45μs	0.2μs (typical)	0.2μs (typical)	0.2μs

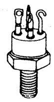
HIGH VOLTAGE

Maximum Collector Current		5 AMP						7 AMP
Package Style		**TO-5**		**TO-66**			**TO-3**	**TO-3**
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO (SUS)}$	150V					UPT721	UPT731	
	200V	2N5666*		2N5664*		UPT722	UPT732	2N6510
	250V					UPT723	UPT733	
	300V		2N5667*		2N5665*	UPT724 UPT725	UPT734 UPT735	
	350V							
	400V							
h_{FE} Minimum		40 @ 1A	25 @ 1A	40 @ 1A	25 @ 1A	25 @ 1A		10 @ 3A
V_{CE} (sat) Max.			0.4V @ 3A			1V @ 3A		1.5V @ 3A
t_f Maximum		0.8μs	1.0μs	0.8μs	1.0μs	0.5μs (typical)		

* Available as JAN, JANTX, JANTXV.


TO-3


TO-59


TO-111

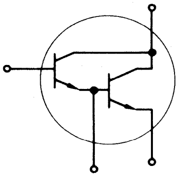
LOW VOLTAGE

Maximum Collector Current		10 AMP		15 AMP		20 AMP		
Package Style		**TO-59**	**TO-111**	**TO-3**		**TO-3**		
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\ (SUS)}$	60V			UPT1032		UPT1132		
	70V							
	75V							2N5039
	80V	2N5658	2N5659	UPT1033		UPT1133		
	90V						2N5038	
	100V			UPT1034 UPT1035	2N6496	UPT1134 UPT1135		
	120V							
h_{FE} Minimum		50 @ 5A		40 @ 5A	12 @ 8A	30 @ 10A	20 @ 12A	20 @ 10A
V_{CE} (sat) Max.		0.5V @ 5A		1.5V @ 15A	1.0V @ 8A	1.5V @ 20A	1.2V @ 12A	1.0V @ 10A
t_f Maximum		0.5μs		0.2μs (typical)	0.5μs	0.4μs (typical)	0.5μs	

HIGH VOLTAGE

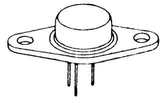
Maximum Collector Current		7 AMP		8 AMP			10 AMP
Package Style		**TO-3**		**TO-3**			**TO-3**
COLLECTOR EMITTER SUSTAINING VOLTAGE $V_{CEO\ (SUS)}$	150V						UPT931
	200V						UPT932
	250V	2N6511		2N6306			UPT933
	300V	2N6512	2N6514	2N6307		UMT1008 2N6544	UPT934 UPT935
	350V	2N6513			2N6308		
	400V					UMT1009 2N6545	
h_{FE} Minimum		10 @ 4A	10 @ 5A	15 @ 3A	12 @ 3A	7 @ 5A	20 @ 5A
V_{CE} (sat) Max.		1.5V @ 4A	1.5V @ 5A	0.8V @ 3A	1.5V @ 3A	1.5V @ 5A	1.5V @ 10A
t_f Maximum		1.5μs		0.4μs		0.9μs (2N6544, 5) 0.4μs (UMT1008, 9)	0.6μs (typical)

NPN POWER DARLINGTONS

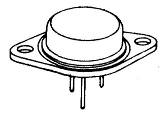


External bias types — for fast switching or other special purpose applications

TO-33



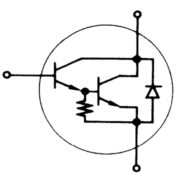
TO-66 (3 PIN)



TO-3 (3 PIN)

Maximum Collector Current		2A						5A					
Package Style		**TO-33**			**TO-66 (3-Pin)**			**TO-33**		**TO-66 (3-Pin)**			**TO-3 (3-Pin)**
COLLECTOR — EMITTER SUSTAINING VOLTAGE $V_{CEO(SUS)}$	60V	U2T301			U2T401								
	80V							2N6350* U2T101		2N6352* U2T201			
	150V		U2T305			U2T405			2N6351* U2T105		2N6353* U2T205		
	200V			U2T712			U2T722					U2T822	U2T832
	300V			U2T713			U2T723					U2T823	U2T833
h_{FE} Minimum		1000 @ 2A		1000 @ 1A	1000 @ 2A		1000 @ 1A	2000 @ 5A	1000 @ 5A	2000 @ 5A	1000 @ 5A	1000 @ 3A	1000 @ 3A
V_{CE} (sat) Maximum		1.5V @ 2A	2.5V @ 2A	1.5V @ 2A	1.5V @ 2A	2.5V @ 2A	1.5V @ 2A	1.5V @ 5A	2.5V @ 5A	1.5V @ 5A	2.5V @ 5A	1.5V @ 3A	1.5V @ 3A
t_f Typical		0.3μsec						0.5μsec					

* Available as JAN and JANTX types.

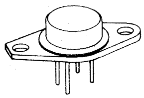


Plastic Package and multiple types with integral bias resistance and shunt diode for maximum economy in standard applications.

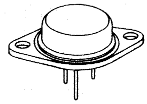
TO-92

Maximum Collector Current		5A (PEAK)
Package Style		**TO-92**
COLLECTOR — EMITTER SUSTAINING VOLTAGE $V_{CEO(SUS)}$	60V	U2TA506
	80V	U2TA508
	100V	U2TA510
	200V	
	300V	
h_{FE} Minimum		500 @ 3A
V_{CE} (sat) Maximum		1.5V @ 3A
t_f Typical		0.8μsec

SWITCHING REGULATOR POWER CIRCUITS



4-Pin TO-66
(Electrically isolated)

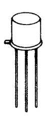


3-Pin TO-3

SWITCHING REGULATOR POWER OUTPUT CIRCUITS (Efficiency 85%)

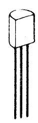
Peak Output Current		5A		15A		20A	
		Pos	Neg	Pos	Neg	Pos	Neg
Package Style		**4-Pin TO-66**		**4-Pin TO-66**		**3-Pin TO-3**	
Input & Output Voltage	60V	PIC600	PIC610	PIC625	PIC635	PIC645	PIC655
	80V	PIC601	PIC611	PIC626	PIC636	PIC646	PIC656
	100V	PIC602	PIC612	PIC627	PIC637	PIC647	PIC657
Fall Time Voltage		75ns		175ns	300ns	150ns	300ns
Fall Time Current		150ns		300ns	300ns	300ns	300ns
On-State Voltage		1.5V @ 2A		1.5V @ 7A		1.5V @ 7A	

PUTs – PROGRAMMABLE UNIJUNCTION TRANSISTORS



TO-18

Peak Recurrent Forward Current	8A	
Package Style	**TO-18**	
MIN. VALLEY CURRENT, I_V / MAX. PEAK POINT CURRENT, I_P: $I_V = 25\mu A$ @ $R_G = 10K$, $I_P = .15\mu A$ @ $R_G = 1Meg$	U13T2	U13T4
$I_V = 70\mu A$ @ $R_G = 10K$, $I_P = 2\mu A$ @ $R_G = 1Meg$	U13T1	U13T3
$I_V = 1mA$ @ $R_G = 200\Omega$, $I_P = .15\mu A$ @ $R_G = 1Meg$	2N6120	
$I_V = 1.5mA$ @ $R_G = 200\Omega$, $I_P = 2\mu A$ @ $R_G = 1Meg$	2N6119 2N6137*	2N6138*
Forward and Reverse Voltage; V_{AK}, V_{AKR}	40V	100V

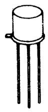


TO-92

Peak Recurrent Forward Current	5A	2A
Package Style	**TO-92**	**TO-92**
MIN. VALLEY CURRENT, I_V / MAX. PEAK POINT CURRENT, I_P: $I_V = 25\mu A$ @ $R_G = 10K$, $I_P = .15\mu$ @ $R_G = 1Meg$	P13T2	
$I_V = 70\mu$ @ $R_G = 10K$, $I_P = 2\mu A$ @ $R_G = 1Meg$	P13T1	
$I_V = 1mA$ @ $R_G = 200\Omega$, $I_P = .15\mu$ @ $R_G = 1Meg$		2N6028
$I_V = 1.5mA$ @ $R_G = 200\Omega$, $I_P = 2\mu A$ @ $R_G = 1Meg$		2N6027
Forward and Reverse Voltage; V_{AK}, V_{AKR}	40V	

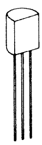
* Available as JAN and JANTX types.

SENSITIVE GATE THYRISTORS (SCRs)



TO-18

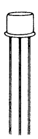
$I_{T(RMS)}$	.5A			
V_{DRM} (V)				
30		2N3027*	2N3030*	ID100
60	AA114	2N3028*	2N3031*	ID101
100		2N3029*	2N3032*	ID102
150				ID103
200	AA116			ID104
300	AA110			ID105
400	AA111			ID106
I_{GT}	200μA	200μA	20μA	200μA
I_H	2mA	5mA	4mA	5mA



TO-92

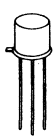
$I_{T(RMS)}$	.8A	
V_{DRM} (V)		
30	2N5060	IP100
60	2N5061	IP101
100	2N5062	IP102
150	2N5063	IP103
200	2N5064	IP104
300	2N6564	IP105
400	2N6565	IP106
I_{GT}	.2μA TYP.	.2μA TYP.
I_H	5mA	5mA

$I_{T(RMS)}$	1.0A	
V_{DRM} (V)		
100	2N6681	IP200
200	2N6682	IP202
400	2N6683	IP204
600	2N6684	IP206
800	2N6685	IP208
I_{GT}	30μA (TYP) 200μA	
I_H	5mA	



TO-9

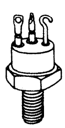
$I_{T(RMS)}$	1.25A	
V_{DRM} (V)		
30	2N1876	2N1870A**
60	2N1877	2N1871A**
100	2N1878	2N1872A**
150	2N1879	2N1873A
200	2N1880	2N1874A**
I_{GT}	20μA	200μA
I_H	3mA	5mA



TO-39

TO-5

$I_{T(RMS)}$	1.6A			
V_{DRM} (V)				
30			2N2322	
60	AD100	2N2323A*	2N2323*	ID200
100	AD101	2N2324A*	2N2324*	ID201
150		2N2325A	2N2325	ID202
200	AD102	2N2326A*	2N2326*	ID203
300	AD103	2N2328A*	2N2328*	ID300
400	AD104		2N2329*	ID301
I_{GT}	2μA	20μA	200μA	200μA
I_H	2mA	2mA	2mA	3mA



TO-59

$I_{T(RMS)}$	5.0A
V_{DRM} (V)	
60	CM100
100	CM101
200	CM102
300	CM103
400	CM104
I_{GT}	200μA
I_H	3mA

*** Available as JAN and JANTX types.**
**** Available as JAN type.**

SCRs-SPECIAL PURPOSE

ULTRAFAST SWITCHING

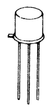
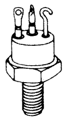
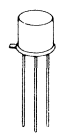
Package				
 TO-18	V_{DRM} (V)	$I_{T(RMS)}$	.4A	
		60V	GA200 GA300	GA200A GA300A
		100V	GA201 GA301	GA201A GA301A
		t_{on}	20ns (TYP.)	20nS (TYP.)
		t_q	2.0μS	.5μS
 TO-59	V_{DRM} (V)	$I_{T(RMS)}$	6A	
		60V	GB200 GB300	GB200A GB300A
		100V	GB201 GB301	GB201A GB301A
		t_{on}	20ns (TYP.)	20nS (TYP.)
		t_q	2.0μS	.5μS

PHOTO SCRs

 TO-18 Lens	On-State Current $I_{T(RMS)}$		0.3A
	Package Style		TO-18 Lens
	REPETITIVE PEAK OFF-STATE VOLTAGE, V_{DRM} and REVERSE VOLTAGE, V_{RRM}	30V	PF30 PF30A
		60V	PF60 PF60A
		100V	PF100 PF100A
		200V	PF200 PF200A
	Key Parameters		λ_T @ $R_{GK} = 27K$ 50 F.C.
			I_H @ $R_{GK} = 4.7K$ 1mA

RADIATION HARDENED SCRs

 TO-18	On-State Current $I_{T(RMS)}$		0.4A
	Package Style		TO-18
	REPETITIVE PEAK OFF-STATE VOLTAGE, V_{DRM} and REVERSE VOLTAGE, V_{RRM}	30V	GA100
		60V	GA101
		80V	GA102
		200V	—
	Key Parameters		I_{GT} (Post 3X10[14] NVT) 20mA
			I_H (Post 3X10[14] NVT) 30mA

ChipStrate POWER SCRs

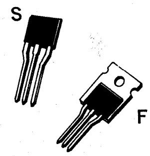
SCRs

4-55A/200-800V

Features:

- Diffused design
- Center gate construction
- Isolated case
- Hard glass passivation
- High dv/dt
- Low power dissipation
- High surge current capability

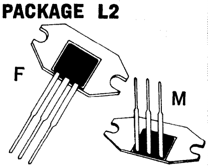
PACKAGE L7



$I_{T\ (RMS)}$		4A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L7RA9042	S, F
	400	L7RA9044	S, F
	600	L7RA9046	S, F
	800	L7RA9048	S, F
I_{GT}		200μA	
I_H		5mA	

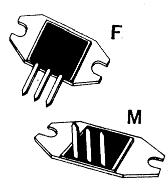
$I_{T\ (RMS)}$		15A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L7R08152	S, F
	400	L7R08154	S, F
	600	L7R08156	S, F
	800	L7R08158	S, F
I_{GT}		15mA	
I_H		25mA	

PACKAGE L2



$I_{T\ (RMS)}$		25A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L2R06252	S, B, F, M
	400	L2R06254	S, B, F, M
	600	L2R06256	S, B, F, M
	800	L2R06258	S, B, F, M
I_{GT}		25mA	
I_H		50mA	

PACKAGE L1



$I_{T\ (RMS)}$		40A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L1R04402	S, B, F, M
	400	L1R04404	S, B, F, M
	600	L1R04406	S, B, F, M
	800	L1R04408	S, B, F, M
I_{GT}		40mA	
I_H		70mA	

$I_{T\ (RMS)}$		55A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L1R05552	S, B, F, M
	400	L1R05554	S, B, F, M
	600	L1R05556	S, B, F, M
	800	L1R05558	S, B, F, M
I_{GT}		100mA	
I_H		100mA	

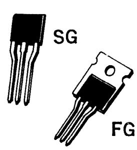
FAST TURN-OFF INVERTER TYPE

Specifically designed for use in inverter and high pulse current applications.

Features:

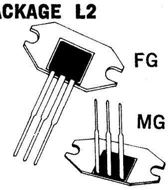
- Fast turn-off time
- High pulse capability
- High dv/dt and di/dt ratings
- Cost effective package design

PACKAGE L7



$I_{T\ (RMS)}$		5A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L7R08052	SG, FG
	400	L7R08054	SG, FG
	600	L7R08056	SG, FG
	800	L7R08058	SG, FG
I_{GT}		40mA	
I_H		50mA	
t_q		$<10\mu S$	

PACKAGE L2



$I_{T\ (RMS)}$		10A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L2R06102	SG, BG, FG, MG
	400	L2R06104	SG, BG, FG, MG
	600	L2R06106	SG, BG, FG, MG
	800	L2R06108	SG, BG, FG, MG
I_{GT}		70mA	
I_H		175mA	
t_q		$<8\mu S$	

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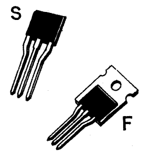
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

TRIACs

3-40A/200-800V
Features:
- Diffused design
- Center gate construction
- Isolated case
- Hard glass passivation
- High dv/dt
- Low power dissipation
- High surge current capability

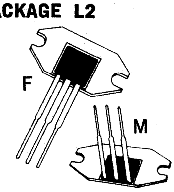
PACKAGE L7



$I_{T (RMS)}$		3A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L7B09032	S, F
	400	L7B09034	S, F
	600	L7B09036	S, F
	800	L7B09038	S, F
I_{GT}		Quadrant 1, 3	25mA
		Quadrant 2, 4	25mA
I_H		25mA	

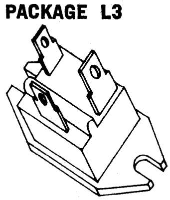
$I_{T (RMS)}$		10A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L7B08102	S, F
	400	L7B08104	S, F
	600	L7B08106	S, F
	800	L7B08108	S, F
I_{GT}		Quadrant 1, 3	30mA
		Quadrant 2, 4	50mA
I_H		30mA	

PACKAGE L2



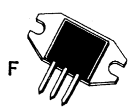
$I_{T (RMS)}$		20A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L2B06202	S, B, F, M
	400	L2B06204	S, B, F, M
	600	L2B06206	S, B, F, M
	800	L2B06208	S, B, F, M
I_{GT}		Quadrant 1, 3	50mA
		Quadrant 2, 4	80mA
I_H		50mA	

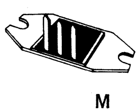
PACKAGE L3



$I_{T (RMS)}$		25A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	CSB20	None
	400	CSB40	None
	600	CSB60	None
I_{GT}		Quadrant 1, 3	50mA
		Quadrant 2, 4	80mA
I_H		50mA	

PACKAGE L1





$I_{T (RMS)}$		30A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L1B04302	S, B, F, M
	400	L1B04304	S, B, F, M
	600	L1B04306	S, B, F, M
	800	L1B04308	S, B, F, M
I_{GT}		Quadrant 1, 3	80mA
		Quadrant 2, 4	120mA
I_H		60mA	

$I_{T (RMS)}$		40A	
		Part Number	Part No. Suffix
Repetitive Peak Off-State Voltage V_{DRM} (V)	200	L1B05402	S, B, F, M
	400	L1B05404	S, B, F, M
	600	L1B05406	S, B, F, M
	800	L1B05408	S, B, F, M
I_{GT}		Quadrant 1, 3	80mA
		Quadrant 2, 4	120mA
I_H		90mA	

A PART NUMBER SUFFIX MUST BE SPECIFIED WHEN ORDERING

SUFFIX **DESCRIPTION**
S, SG — SOLDERABLE BACK, STRAIGHT LEADS
B, BG — SOLDERABLE BACK, PREBENT LEADS
F, FG — FLANGE MOUNTED, STRAIGHT LEADS
M, MG — FLANGE MOUNTED, PREBENT LEADS

PIN DIODES

SWITCHING PIN DIODES

Type	Voltage Rating Range	Capacitance (OV, 1 GHz) C_T max.	Forward Resistance (100mA, 1 GHz) R_F max.	Parallel Resistance (100V, 1 GHz) R_p min.	Average Thermal Resistance Θ_A max.	Average Power Dissipation P_A max.	Peak Power Dissipation P_p max.	Carrier Lifetime I_F=10mA min.
	(V_I)	(pF)	(Ω)	(KΩ)	(°C/W)	(W)	(KW)	τ (μS)
UM4000	100-1000	3.0	0.5	2	6	25	100	5.0
UM4900	100-600	3.0	0.5	2	4	37	100	5.0
UM6000	100-1000	0.6	1.7	15	25	6	25	1.0
UM6200	100-400	1.1	0.4	10	25	6	10	0.6
UM6600	100-1000	0.4	2.5	10	35	4	13	1.0
UM7000	100-1000	0.9	1.0	10	15	10	60	2.5
UM7100	100-800	1.2	0.6	8	15	10	35	2.0
UM7200	100-400	2.2	0.25	7	15	10	20	1.5

HIGH POWER ATTENUATOR & MODULATOR PIN DIODES

Type	Voltage Ratings Range	Total Capacitance (OV, 1 GHz) C_T max.	RF Resistance (100mA, 1 GHz) R_F max.	RF Resistance (10μA, 1 GHz) R_F max.	Average Thermal Resistance Θ_A max.	Average Power Dissipation P_A max.	Carrier Lifetime I_F=10mA min.
	V_I	(pF)	(Ω)	(Ω)	(°C/W)	(W)	(μS)
UM4300	100-1000	2.2	1.5 max.	1000 min.	8	18	5.0
UM7300	100-1000	0.7	3.5 min. 2.0 typ.	3000 min.	20	7.5	2.5

GENERAL PURPOSE PIN DIODE

Type	Voltage Rating (I_R=10μA)	Total Capacitance (50V, 1MHz) C_T max.	RF Resistance (10μA, 100MHz) R_F max.	RF Resistance (20mA, 100MHz) R_F max.	RF Resistance (100mA, 100MHz) R_F max.	Carrier Lifetime (I_R=10mA) min.
	(V_I)	(pF)	(Ω)	(Ω)	(Ω)	τ (μS)
1N5767	100	0.4	1000 min. 3000 typ.	8 max. 4 typ.	2.5 max. 1.5 typ.	1

LOW DISTORTION ATTENUATOR PIN DIODES

Type	Voltage Rating I_R=10μA	Total Capacitance (OV, 100MHz)	RF Resistance (100mA, 100MHz) Max.	RF Resistance (10μA, 100MHz) Min.	Forward Current (R_F=75Ω F=100MHz) Typ.	Carrier Lifetime (I_F=10mA) Typ.
	(V_I)	C_T max. (pF)	R_F max. (Ω)	R_F max. (Ω)	I_F (mA)	τ (μS)
1N5957	100	0.4	3.5 max. 2 typ.	1500 min. 3000 typ.	1.0	2
UM9301	50	0.8	3.5	3000	1.1	4

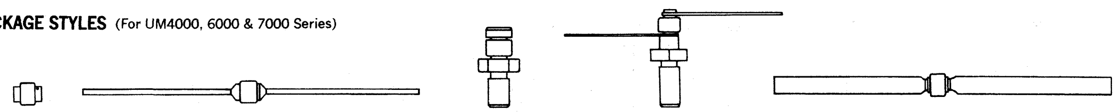
TWO WAY RADIO ANTENNA SWITCHES

Type	Voltage Rating (I_R=10μA)	Total Capacitance (0V, 100MHz) C_T max.	RF Resistance (50mA, 100MHz) R_F max.	Transmit Harmonic Distortion F=50MHz 1=20mA	Receive Third Order Distortion (Pin-10mW, 0 Bias) FA=50MHz FB=51MHz Max.	Average Power Dissipation P_A Max.
	(V_I)	(pF)	(Ω)	(dB)	(dB)	(W)
UM9401 and UM9402	50	1.5	1.0	−80	−60	5.5
UM9415	50	4.0	1.0	−80	60	10

RADIATION DETECTORS

Type	Photocurrent 10° Rad (Si), 50V / Sec mA min.	Photocurrent Rise Time nSec Typ.	Reverse Current 50V μA max.	Capacitance F=1 MHz, V=50V pf max.
UM9441	4.0	10	1.0	15
UM9442	6.0	10	1.0	20

PACKAGE STYLES (For UM4000, 6000 & 7000 Series)



A Style Basic Diode | **B Style Round Axial Leads** | ***C Style Stud** | ***D Style Insulated Stud** | **E Style Ribbon Axial Leads**

*Not available for UM6000, UM6600, UM6200.

VOLTAGE RATINGS

Series	100V	200V	400V	600V	800V	1000V
UM4000	√	√		√		√
UM4300	√	√		√		√
UM4900	√	√		√		
UM6000	√	√		√		√
UM6200	√	√	√			
UM6600	√	√		√		√
UM7000	√	√		√		√
UM7100	√	√	√		√	
UM7200	√	√	√			
UM7300	√	√		√		√

ORDERING INFORMATION

Part numbers of Microwave PIN diodes consist of the letters UM followed by four digits and one or two letters. The first two digits indicate the diode series, the next two digits specify the voltage rating in hundreds of volts. The remaining letters denote the package style. Reverse polarity is available for C, and D, style and denoted by adding second letter R.

For Example: UM|60|06|B|

|Series 6000| |600 Volts| |Style B|

NPN POWER SWITCHING TRANSISTORS

Type	$V_{CEO(sus)}$ (V)	Min. h_{FE} @ I_C (A)	Max. $V_{CE(sat)}$ @ I_C (V) (A)	Max. (t_f) Fall Time (t_f) @ $I_C/I_{B1}/I_{B2}$ (μs) @ (A)	Max. $E_{s/b}$ (μJ)	Pkg.
2.0A						
UMT3584	250	8 @ 1.0	0.75 @ 1.0	3.0 @ 1/.1/.1	200	TO-220
UMT3585	300	8 @ 1.0	0.75 @ 1.0	3.0 @ 1/.1/.1	200	TO-220
3.0A						
UMT1203	300	7 @ 2.0	1.2 @ 2.0	0.7 @ 2/.4/.4	80	TO-220
UMT1204	400	7 @ 2.0	1.2 @ 2.0	0.7 @ 2/.4/.4	80	TO-220
7.0A						
2N6510	200	10 @ 3.0	1.5 @ 3.0	1.5 @ 5/1/1	—	TO-3
2N6511	250	10 @ 4.0	1.5 @ 4.0	1.5 @ 4/.8/.8	—	TO-3
2N6512	300	10 @ 4.0	1.5 @ 4.0	1.5 @ 4/.8/.8	—	TO-3
2N6514	300	10 @ 5.0	1.5 @ 5.0	1.5 @ 5/1/1	—	TO-3
2N6513	350	10 @ 4.0	1.5 @ 4.0	1.5 @ 4/.8/.8	—	TO-3
8.0A						
2N6306	250	15 @ 3.0	0.8 @ 3.0	0.4 @ 3/.6/1.5	180	TO-3
2N6307	300	15 @ 3.0	0.8 @ 3.0	0.4 @ 3/.6/1.5	180	TO-3
2N6544	300	7 @ 5.0	1.5 @ 5.0	1.0 @ 5/1/1	500	TO-3
UMT1008	300	7 @ 5.0	1.5 @ 5.0	0.4 @ 5/1/1	1500	TO-3
2N6308	350	12 @ 3.0	1.5 @ 3.0	0.4 @ 3/.6/1.5	180	TO-3
2N6545	400	7 @ 5.0	1.5 @ 5.0	1.0 @ 5/1/1	500	TO-3
UMT1009	400	7 @ 5.0	1.5 @ 5.0	0.4 @ 5/1/1	1500	TO-3
10.0A						
2N6354	120	10 @ 10.0	1.0 @ 10.0	0.2 @ 5/.5/.5	300	TO-3
15.0A						
2N6496	100	12 @ 8.0	1.0 @ 8.0	0.3 @ 8/.8/.8	5700	TO-3
20.0A						
2N5039	75	20 @ 10.0	1.0 @ 10.0	0.5 @ 10/1/1	13000	TO-3
2N5038	90	20 @ 12.0	1.2 @ 12.0	0.5 @ 12/1.2/1.2	13000	TO-3

SWITCHING REGULATOR POWER OUTPUT CIRCUITS

Type	Output Current, Pk.	Input/Output Voltage	Polarity	Fall-Time Volt. (V)	Fall-Time Current (nS)	On-State Volt. @ I (V) @ (I)	Pkg.
PIC600	5A	60	Pos.	75	150	1.5 @ 2	4 PIN TO-66 (Isolated)
PIC601		80	Pos.				
PIC602		100	Pos.				
PIC610		60	Neg.				
PIC611		80	Neg.				
PIC612		100	Neg.				
PIC625	15A	60	Pos.			1.5 @ 7	4 PIN TO-66 (Isolated)
PIC626		80	Pos.	175	300		
PIC627		100	Pos.				
PIC635		60	Neg.				
PIC636		80	Neg.	300	300		
PIC637		100	Neg.				
PIC645	20A	60	Pos.			1.5 @ 7	3 PIN TO-3
PIC646		80	Pos.	150	300		
PIC647		100	Pos.				
PIC655		60	Neg.				
PIC656		80	Neg.	300	300		
PIC657		100	Neg.				

TRANSIENT VOLTAGE SUPPRESSORS

Type	Stand-Off Voltage	Breakdown Voltage, BV(min.)	Ratings and Specifications
TVS505	5V	6V	Peak Pulse Power (1mSec duration) 500W
TVS510	10	11.1	Continuous Power 5W
TVS512	12	13.8	1 Picosecond Transient Response Time
TVS515	15	16.7	Package: Axial Leaded Glass
TVS518	18	20.4	
TVS524	24	28.4	
TVS528	28	30.7	
UZS306	5.2	6.8	Peak Pulse Power (1mSec duration) 150W
UZS312	9.1	12	Continuous Power 3W
UZS315	11.4	15	1 Picosecond Transient Response Time
UZS318	13.7	18	Package: Axial Leaded Glass
UZS356	42.6	56	Additional Voltages Available
UZS426	198	260	
UZS428	213	280	
UZS440	304	400	

THYRISTORS – SCRs

Crowbars

Type	V_{DRM}, V_{RRM}	Ratings and Specifications
25A		Surge Current, I_{TSM} 250A
L2R06252F	200V	On-State Voltage, V_{TM} .... 2.1V @ 50A
L2R06254F	400V	dv/dt 200V/μSec
L2R06256F	600V	Package: Metalized ceramic substrate on TO-3 Flange
L2R06258F	800V	Other SCRs available with current ratings up to 55A

Inverter Power Switches

Type	V_{DRM}, V_{RRM}	Ratings and Specifications
10A		Surge Current, I_{TSM} 120A
L2R06102FG	200V	di/dt 150A/μs
L2R06104FG	400V	dv/dt 400V/μs
L2R06106FG	600V	On-State Voltage, V_{TM} .... 10V @ 100A
L2R06108FG	800V	Circuit Commutated Turn-Off Time, T_q .... 6 μs
		Packages: Metalized ceramic substrate on TO-3 Flange
		5A Version also available

SILICON POWER RECTIFIERS

Schottky

Type	V_{RWM}	Ratings and Specifications	
60A			
SD51	45V	Repetitive Peak Forward Current, I_{FRM}	120A
		Surge Current, I_{FSM}	800A
		Maximum Junction Temperature, T_J	150°C
		Forward Voltage, V_F	.6V @ 60A
		Reverse Current, i_R @ 35V, 125°C	200mA
		Package: DO-5	
75A			
USD520	20V	Repetitive Peak Forward Current, I_{FRM}	150A
USD535	35V	Surge Current, I_{FSM}	1000A
USD545	45V	Maximum Junction Temperature, T_J	175°C
		Forward Voltage, V_F	.6V @ 60A
		Reverse Current, i_R @ V_{RWM}, 125°C	50mA
		Package: DO-5	

High Efficiency, Fast Switching

Type	V_{RWM}	Ratings and Specifications	
2.5A			
UES1101	50V	Surge Current, I_{FSM}	35A
UES1102	100V	Forward Voltage, V_F	.895V @ 2A
UES1103	150V	Reverse Recovery Time, t_{rr}	25nSec
		Package: Axial Leaded Glass	
6A			
UES1301	50V	Surge Current, I_{FSM}	125A
UES1302	100V	Forward Voltage, V_F	.850V @ 6A
UES1303	150V	Reverse Recovery Time, t_{rr}	30nSec
		Package: Axial Leaded Glass	
25A			
UES701	50V	Surge Current, I_{FSM}	400A
UES702	100V	Forward Voltage, V_F	.825V @ 25A
UES703	150V	Reverse Recovery Time, t_{rr}	35nSec
		Package: DO-4	
30A			
UES601	50V	Surge Current, I_{FSM}	800A
UES602	100V	Forward Voltage, V_F	.80V @ 30A
UES603	150V	Reverse Recovery Time, t_{rr}	50nSec
		Package: TO-3	
70A			
UES801	50V	Surge Current, I_{FSM}	800A
UES802	100V	Forward Voltage, V_F	.840V @ 70A
UES803	150V	Reverse Recovery Time, t_{rr}	50nSec
		Package: DO-5	

High Voltage, High Efficiency, Fast Switching

Type	V_{RWM}	Ratings and Specifications	
2A			
UES1104	200V	Surge Current, I_{FSM}	20A
UES1105	300V	Forward Voltage, V_F	1.15V @ 1A
UES1106	400V	Reverse Recovery Time, t_{rr}	50nSec
		Package: Axial Leaded Glass	
5A			
UES1304	200V	Surge Current, I_{FSM}	70A
UES1305	300V	Forward Voltage, V_F	1.1V @ 3A
UES1306	400V	Reverse Recovery Time, t_{rr}	50nSec
		Package: Axial Leaded Glass	
20A			
UES704	200V	Surge Current, I_{FSM}	400A
UES705	300V	Forward Voltage, V_F	1.15V @ 20A
UES706	400V	Reverse Recovery Time, t_{rr}	50nSec
		Package: DO-4	
30A			
UES604	200V	Surge Current, I_{FSM}	800A
UES605	300V	Forward Voltage, V_F	1.1V @ 30A
UES606	400V	Reverse Recovery Time, t_{rr}	50nSec
		Package: TO-3	
50A			
UES804	200V	Surge Current, I_{FSM}	800A
UES805	300V	Forward Voltage, V_F	1.15V @ 50A
UES806	400V	Reverse Recovery Time, t_{rr}	50nSec
		Package: DO-5	

SILICON POWER RECTIFIERS (continued)

High Efficiency, Center-Tap Rectifiers and Doublers

Type	V_{RWM}	Ratings and Specifications
30A		
UES2601 UES2602 UES2603	50V 100V 150V	Surge Current, I_{FSM} .... 400A Forward Voltage, V_F .... .825V @ 15A Reverse Recovery Time, t_{rr} .... 35nSec Package: TO-3
UES2604 UES2605 UES2606	200V 300V 400V	Surge Current, I_{FSM} .... 400A Forward Voltage, V_F .... 1.15V @ 15A Reverse Recovery Time, t_{rr} .... 50nSec Package: TO-3

General Purpose, Fast Recovery

Type	V_{RWM}	Ratings and Specifications
1A		
U114F U114A U114B U114C U114D U114E U114M U114N	50V 100V 200V 300V 400V 500V 600V 800V	Surge Current, I_{FSM} .... 40A Forward Voltage, V_F .... 1.1V @ 1A Reverse Recovery Time, t_{rr} .... 200nSec Package: Axial Leaded Glass
3A		
U115F U115A U115B U115C U115D U115E U115M	50V 100V 200V 300V 400V 500V 600V	Surge Current, I_{FSM} .... 110A Forward Voltage, V_F .... 1.2V @ 3A Reverse Recovery Time, t_{rr} .... 200nSec Package: Axial Leaded Glass

General Purpose, Standard Recovery

Type	V_{RWM}	Ratings and Specifications
1A		
U14F U14A U14B U14D U14M U14N U14P	50V 100V 200V 400V 600V 800V 1000V	Surge Current, I_{FSM} .... 50A Forward Voltage, V_F .... 1.1V @ 1A Package: Axial Leaded Glass
3A		
U15F U15A U15B U15D U15M U15N	50V 100V 200V 400V 600V 800V	Surge Current, I_{FSM} .... 125A Forward Voltage, V_F .... 1.1V @ 3A Package: Axial Leaded Glass

SILICON POWER RECTIFIERS
Schottky

TYPE	OUTPUT CURRENT	V_{RWM}	MAXIMUM FORWARD VOLTAGE	MAXIMUM REVERSE CURRENT	SURGE CURRENT	PACKAGE
SD51	60A	45V	0.6V @ 60A	200mA @ 35V T_C=125°C	800A	DO-5
USD520 USD535 USD545	75A	20V 35V 45V	0.6V @ 60A	50mA @ V_{RWM} T_C=125°C	1000A	DO-5

High Efficiency, Fast Switching

TYPE	OUTPUT CURRENT	V_{RWM}	MAXIMUM FORWARD VOLTAGE	REVERSE RECOVERY TIME	PACKAGE	MIL-S-19500
1N5802 1N5804 1N5806	2.5A	50V 100V 150V	.875V @ 1A	25nSec	Axial Axial Axial	/477 * /477 /477
1N5807 1N5809 1N5811	6.0A	50V 100V 150V	.875V @ 4A	30nSec	Axial Axial Axial	/477 * /477 /477
1N5812 1N5814 1N5816	20A	50V 100V 150V	.900V @ 10A	35nSec	DO-4 DO-4 DO-4	/478 * /478 /478
UES601 UES602 UES603	30A	50V 100V 150V	.915V @ 30A	50nSec	TO-3 TO-3 TO-3	N/A
UES501 UES503 UES505	50A	50V 100V 150V	.95V @ 50A	50nSec	DO-5 DO-5 DO-5	N/A

*Series available as JAN, JANTX and JANTXV

General Purpose, Fast Recovery

TYPE	OUTPUT CURRENT	V_{RWM}	MAXIMUM FORWARD VOLTAGE	REVERSE RECOVERY TIME	PACKAGE	MIL-S-19500
1N4942	1A	200V	1.3V @ 1A	150nSec	Axial	/359 *
1N4944	1A	400V	1.3V @ 1A	150nSec	Axial	/359
1N4946	1A	600V	1.3V @ 1A	250nSec	Axial	/359
1N5615	1A	200V	1.6V @ 3A	150nSec	Axial	/429 *
1N5617	1A	400V	1.6V @ 3A	250nSec	Axial	/429
1N5619	1A	600V	1.6V @ 3A	250nSec	Axial	/429
1N5186	3A	100V	1.5V @ 9A	150nSec	Axial	/424 **
1N5187	3A	200V	1.5V @ 9A	200nSec	Axial	/424
1N5188	3A	400V	1.5V @ 9A	250nSec	Axial	/424
1N5189	3A	600V	1.5V @ 9A	400nSec	Axial	/424
1N5415	3A	50V	1.5V @ 9A	150nSec	Axial	/411 *
1N5416	3A	100V	1.5V @ 9A	150nSec	Axial	/411
1N5417	3A	200V	1.5V @ 9A	150nSec	Axial	/411
1N5418	3A	400V	1.5V @ 9A	150nSec	Axial	/411
1N5419	3A	500V	1.5V @ 9A	250nSec	Axial	/411
1N5420	3A	600V	1.5V @ 9A	400nSec	Axial	/411
1N3909	30A	50V	1.4V @ 95A	200nSec	DO-5	/308 **
1N3910	30A	100V	1.4V @ 95A	200nSec	DO-5	/308
1N3911	30A	200V	1.4V @ 95A	200nSec	DO-5	/308
1N3912	30A	300V	1.4V @ 95A	200nSec	DO-5	/308
1N3913	30A	400V	1.4V @ 95A	200nSec	DO-5	/308

*Series available as JAN, JANTX and JANTXV
**Series available as JAN and JANTX

SILICON POWER RECTIFIERS (continued)
General Purpose, Standard Recovery

TYPE	OUTPUT CURRENT	V_{RWM}	MAXIMUM FORWARD VOLTAGE	SURGE CURRENT	PACKAGE	MIL-S-19500
1N483B	200mA	70V	1.0V @ 100mA	2A	DO-7	/118 **
1N485B	200mA	180V	1.0V @ 100mA	2A	DO-7	/118
1N645-1	400mA	270V	1.0V @ 400mA	5A	DO-35	/240 *
1N4245	1A	200V	1.3V @ 3A	25A	Axial	/286 *
1N4246	1A	400V	1.3V @ 3A	25A	Axial	/286
1N4247	1A	600V	1.3V @ 3A	25A	Axial	/286
1N4248	1A	800V	1.3V @ 3A	25A	Axial	/286
1N4249	1A	1000V	1.3V @ 3A	25A	Axial	/286
1N5614	1A	200V	1.3V @ 3A	30A	Axial	/427 *
1N5616	1A	400V	1.3V @ 3A	30A	Axial	/427
1N5618	1A	600V	1.3V @ 3A	30A	Axial	/427
1N5620	1A	800V	1.3V @ 3A	30A	Axial	/427
1N3611	2A	200V	1.1V @ 1A	20A	Axial	/228 **
1N3612	2A	400V	1.1V @ 1A	20A	Axial	/228
1N3613	2A	600V	1.1V @ 1A	20A	Axial	/228
1N3614	2A	800V	1.1V @ 1A	20A	Axial	/228
1N5550	3A	200V	1.2V @ 9A	100A	Axial	/420 *
1N5551	3A	400V	1.2V @ 9A	100A	Axial	/420
1N5552	3A	600V	1.2V @ 9A	100A	Axial	/420
1N5553	3A	800V	1.2V @ 9A	100A	Axial	/420
1N1184	35A	100V	1.4V @ 110A	500A	DO-5	/297 **
1N1186	35A	200V	1.4V @ 110A	500A	DO-5	/297
1N1188	35A	400V	1.4V @ 110A	500A	DO-5	/297

*Series available as JAN, JANTX and JANTXV
**Series available as JAN and JANTX

High Efficiency, Center-Tap Rectifiers and Doublers

TYPE	V_{RWM}	MAXIMUM FORWARD VOLTAGE	REVERSE RECOVERY TIME	OUTPUT CURRENT	SURGE CURRENT	PACKAGE
UES2601	50V	.930V		30A		TO-3
UES2602	100V	@	35nSec	30A	400A	TO-3
UES2603	150V	15A		30A		TO-3

SWITCHING DIODES
Low Current

TYPE	OUTPUT CURRENT	V_{RWM}	MAXIMUM FORWARD VOLTAGE	REVERSE RECOVERY TIME	PACKAGE	MIL-S-19500
1N914	75 mA	100V	1.0V @ 10 mA	5nSec	DO-35	/116 **
1N3064	75 mA	75V	1.0V @ 10 mA	4nSec	DO-7	/144 *
1N4148-1	150 mA	100V	1.0V @ 10 mA	5nSec	DO-35	/116 **
1N4153	150 mA	75V	.88V @ 20 mA	4nSec	DO-35	/337 **
1N4150-1	200 mA	75V	.74V @ 10 mA	4nSec	DO-35	/231 **
1N4454-1	200 mA	75V	1.0V @ 10 mA	4nSec	DO-35	/144 *
1N3600	200 mA	75V	.74V @ 10 mA	4nSec	DO-7	/231 **
1N4500	300 mA	80V	.77V @ 20 mA	6nSec	DO-35	/403 *

*Available as JAN and JANTX
**Available as JAN, JANTX and JANTXV

MILITARY DESIGNERS' GUIDE

NPN POWER SWITCHING TRANSISTORS

TYPE	MAXIMUM COLLECTOR CURRENT	$V_{CEO(sus)}$ (V)	MINIMUM h_{FE} @ I_C (A)	MAXIMUM $V_{CE(sat)}$ @ I_C	MAXIMUM FALL-TIME (t_f)	PACKAGE	MIL-S-19500
2N5660	2A	200V	40 @ .5A	.4V @ 1A	0.4 μSec	TO-66	/454 *
2N5661	2A	300V	25 @ .5A	.4V @ 1A	0.6 μSec	TO-66	/454 *
2N5662	2A	200V	40 @ .5A	.4V @ 1A	0.4 μSec	TO-5	/454 *
2N5663	2A	300V	25 @ .5A	.4V @ 1A	0.6 μSec	TO-5	/454 *
2N3418	3A	60V	20 @ 1A	.5V @ 2A	1.2 μSec	TO-5	/393 *
2N3419	3A	80V	20 @ 1A	.5V @ 2A	1.2 μSec	TO-5	/393
2N3420	3A	60V	40 @ 1A	.5V @ 2A	1.2μSec	TO-5	/393
2N3421	3A	80V	40 @ 1A	.5V @ 2A	1.2 μSec	TO-5	/393
2N2151	5A	80V	40 @ 1A	1.0V @ 1A	—	TO-59	/277 **
2N2880	5A	80V	40 @ 1A	.25V @ 1A	0.3 μSec	TO-59	/315 *
2N3749	5A	80V	40 @ 1A	.25V @ 1A	0.3 μSec	TO-111	/315
2N3996	5A	80V	40 @ 1A	.25V @ 1A	0.8 μSec	TO-111	/374 *
2N3997	5A	80V	80 @ 1A	.25V @ 1A	1.0 μSec	TO-111	/374
2N3998	5A	80V	40 @ 1A	.25V @ 1A	0.8 μSec	TO-59	/374
2N3999	5A	80V	80 @ 1A	.25V @ 1A	1.0 μSec	TO-59	/374
2N5664	5A	200V	40 @ 1A	.4V @ 3A	0.8 μSec	TO-66	/455 *
2N5665	5A	300V	25 @ 1A	.4V @ 3A	1.0 μSec	TO-66	/455
2N5666	5A	200V	40 @ 1A	.4V @ 3A	0.8 μSec	TO-5	/455
2N5667	5A	300V	25 @ 1A	.4V @ 3A	1.0 μSec	TO-5	/455
2N6306	8A	250V	15 @ 3A	.8V @ 3A	0.4 μSec	TO-3	/498 *
2N6307	8A	300V	15 @ 3A	.8V @ 3A	0.4 μSec	TO-3	/498
2N6544	8A	300V	7 @ 5A	1.5V @ 3A	0.9 μSec	TO-3	N/A
UMT1008	8A	300V	7 @ 5A	1.5V @ 3A	0.4 μSec	TO-3	N/A
2N6308	8A	350V	12 @ 3A	1.5V @ 3A	0.4 μSec	TO-3	/498
2N6545	8A	400V	7 @ 5A	1.5V @ 5A	0.9 μSec	TO-3	N/A
UMT1009	8A	400V	7 @ 5A	1.5V @ 5A	0.4 μSec	TO-3	N/A
2N4150	10A	70V	10 @ 10A	0.6V @ 5A	0.4μSec	TO-5	/394 *
2N6354	10A	120V	10 @ 10A	1.0V @ 10A	0.2 μSec	TO-3	N/A
2N6496	15A	100V	12 @ 8A	1.0V @ 8A	0.3 μSec	TO-3	N/A
2N5038	20A	90V	20 @ 12A	1.2V @ 12A	0.5 μSec	TO-3	/439 **
2N5039	20A	75V	20 @ 10A	1.0V @ 10A	0.5 μSec	TO-3	/439

*Series available as JAN, JANTX, and JANTXV
**Series available as JAN and JANTX

POWER DARLINGTONS

TYPE	D.C. COLLECTOR CURRENT	B_{VCEO}	MINIMUM h_{FE} @ 5A	PACKAGE	MIL-S-19500
2N6350	5A	80V	2000	TO-33	/472 **
2N6351	5A	150V	1000	TO-33	/472
2N6352	5A	80V	2000	TO-33	/472
2N6353	5A	150V	1000	TO-33	/472

**Series available as JAN, JANTX and JANTXV

POWER ZENERS AND TRANSIENT SUPPRESSORS

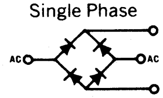
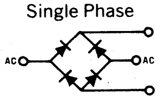
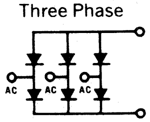
TYPE	AVERAGE D.C. POWER	BREAKDOWN VOLTAGE RANGE	PEAK POWER	PACKAGE	MIL-S-19500
1N5555-8	1.0W	33V-191V	1500W	DO-13	/434 **
1N4461-83	1.5W	6.8V-56V	140W	Axial	/406 *
1N4954-96	5.0W	6.8V-390V	900W	Axial	/356 *
1N5610-13	6.0W	33V-191V	1500W	Axial	/434 **
UZ7706-7110	10W	6.8V-100V	2000W	Stud Mount	N/A

*Series available as JAN, JANTX and JANTXV
**Series available as JAN and JANTX

SWITCHING REGULATOR POWER OUTPUT CIRCUITS

TYPE	OUTPUT CURRENT, PK.	INPUT/OUTPUT VOLTAGE*	POLARITY	FALL-TIME VOLTAGE (V)	FALL-TIME CURRENT (nS)	ON-STATE VOLT. @ CURR. (V) @ (I)	PACKAGE
PIC600		60	Pos.				
PIC601		80	Pos.				
PIC602	5A	100	Pos.	75	150	1.5 @ 2	4 PIN TO-66 (Isolated)
PIC610		60	Neg.				
PIC611		80	Neg.				
PIC612		100	Neg.				
PIC625		60	Pos.				
PIC626		80	Pos.	175	300		
PIC627	15A	100	Pos.			1.5 @ 7	4 PIN TO-66 (Isolated)
PIC635		60	Neg.				
PIC636		80	Neg.	300	300		
PIC637		100	Neg.				
PIC645		60	Pos.				
PIC646		80	Pos.	150	300		
PIC647	20A	100	Pos.			1.5 @ 7	3 PIN TO-3
PIC655		60	Neg.				
PIC656		80	Neg.	300	300		
PIC657		100	Neg.				

BRIDGE RECTIFIERS
40 Hz - 5KHz

TYPE	CONFIGURATION	OUTPUT CURRENT	REVERSE VOLTAGE	SPECIFICATIONS	MIL-S-19500
469-1 469-2 469-3	Single Phase 	10A	200V 400V 600V	V_F @ 15.7A, 135 Max I_R @ V_R, 2μA Max I_{SURGE}, 100 Amp	/469 *
SPA25 SPB25 SPC25 SPD25	Single Phase 	25A	100V 200V 400V 600V	V_F @ 39A, 1.4V Max I_R @ V_R, 2μA Max I_{SURGE}, 150 Amp	/446 *
483-1 483-2 483-3	Three Phase 	25A	200V 400V 600V	V_F @ 39A, 1.3 V Max I_R @ V_R, 3μA Max I_{SURGE}, 150 Amp	/483 **

*Series available as JAN and JANTX
**Series available as JANTX only

HIGH VOLTAGE DOORBELL® MODULES
40 Hz - 5KHz

TYPE	OUTPUT CURRENT	REVERSE VOLTAGE	MAXIMUM REVERSE CURRENT @ V_R	MAXIMUM FORWARD VOLTAGE	SURGE CURRENT	MIL-S-19500
1N5597	1A	10KV	1μA	19V @ 1A	30A	
1N5600	2A	5KV	5μA	10V @ 2A	80A	/404 *
1N5603	5A	5KV	5μA	10V @ 5A	200A	

*Series available as JAN only

THYRISTORS

Silicon Control Rectifiers

TYPE	D.C. ON STATE CURRENT	V_{DRM}	MAXIMUM I_{GT}	MAXIMUM V_{GT}	PACKAGE	MIL-S-19500
2N3027	.5A	30V	20µA	.6V	TO-18	/419 **
2N3028	.5A	60V	20µA	.6V	TO-18	/419
2N3029	.5A	100V	20µA	.6V	TO-18	/419
2N3030	.5A	30V	20µA	.6V	TO-18	/419
2N3031	.5A	60V	20µA	.6V	TO-18	/419
2N3032	.5A	100v	20µA	.6V	TO-18	/419
2N1870A	1.25A	30V	200µA	.8V	TO-9	/198 *
2N1871A	1.25A	60V	200µA	.8V	TO-9	/198
2N1872A	1.25A	100V	200µA	.8V	TO-9	/198
2N1873A	1.25A	150V	200µA	.8V	TO-9	N/A
2N1874A	1.25A	200V	200µA	.8V	TO-9	/198
2N2323A	1.6A	50V	20µA	.6V	TO-5	/276 **
2N2324A	1.6A	100V	20µA	.6V	TO-5	/276
2N2325A	1.6A	150V	20µA	.6V	TO-5	N/A
2N2326A	1.6A	200V	20µA	.6V	TO-5	/276
2N2327A	1.6A	250V	20µA	.6V	TO-5	N/A
2N2328A	1.6A	300V	20µA	.6V	TO-5	/276
2N2329A	1.6A	400V	20µA	.6V	TO-5	/276
CM100	5A	60V	200µA	.8V	TO-59	N/A
CM101	5A	100V	200µA	.8V	TO-59	N/A
CM102	5A	200V	200µA	.8V	TO-59	N/A
CM103	5A	300V	200µA	.8V	TO-59	N/A
CM104	5A	400V	200µA	.8V	TO-59	N/A

*Series available as JAN only
**Series available as JAN and JANTX

Ultra Fast Switching

TYPE	D.C. ON STATE CURRENT	V_{DRM}	RISE TIME	COMMUTATED TURN-OFF TIME	PACKAGE
GA200	.4A	60V	25nSec	2.0µSec	TO-18
GA201	.4A	100V	20nSec	2.0µSec	TO-18
GB200	6A	60V	25nSec	2.0µSec	TO-59
GB201	6A	100V	20nSec	2.0µSec	TO-59

PROGRAMMABLE UNIJUNCTION TRANSISTORS

TYPE	V_{AK}	PEAK CURRENT	VALLEY CURRENT	PACKAGE	MIL-S-19500
2N6137	40V	2µA @ R_G=1 MEGΩ	1.5mA @ R_G=200Ω	TO-18	/493 *
2N6138	100V	2µA @ R_G=1 MEGΩ	1.5mA @ R_G=200Ω	TO-18	/493

*Series available as JAN, JANTX and JANTXV

IV. APPLICATIONS

APPLICATION AND DESIGN NOTES

SUBJECT — **PUBLICATION**

PIN DIODES

PIN Diodes in RF Applications **MW-70-1**
This application note gives a general introduction to the PIN diode as a circuit element. It describes the equivalent circuit, power handling capabilities and discusses distortion.

Design Curves for RF Switches **MW-70-2**
This note considers rf switches in four common configurations and shows performance curves for the UM4000 series PIN diodes in these switches.

PIN Diodes in CATV Applications **UM9301**
This note describes the bridge TEE attenuator circuit used in CATV repeaters. It shows the performance of Unitrode UM9301 series PIN diodes used in this application.

PIN Diodes in Two Way Radio Antenna Switches **UM9401**
This is a design guide showing the expected performance of PIN diodes in quarter-wave and broad band antenna switches. It discusses distortion and the power handling capability of PIN diodes and shows the performance of the UM9401 series PIN diodes in this application.

POWER TRANSISTORS & DARLINGTONS

Power Darlingtons as Switching Devices **U-70**
The Unitrode monolithic power Darlington is characterized and compared with other switching methods. Unique advantages are discussed and basic circuits for many modern applications are shown.

High Voltage, High Performance Power Switching Transistors **U-75**
This note describes a new generation of high voltage switching transistors with significantly improved switching speed and E_s/I_b characteristics. Efficient 25 KHz operation in off-line switching regulator and inverter application is achieved with minimal turn-off base drive.

Thermal Design Considerations for Operating Unitrode's TO-92 Transistors and Darlingtons in Pulsed-Power Applications **U-77**
This note describes convenient methods for determining allowable peak power, peak junction temperature. Design examples are included.

Unitrode's New Power Switching Transistor **DN-2**

How to Safely Check Sustaining Voltage on Power Transistors **DN-5**

PUTs

Programmable Unijunction Transistors **U-66**
The PUT is described and compared with the UJT. It is fully characterized and examples of its use are shown.

Programmable Bidirectional Diac Using PUT **DN-9**

H.V. RECTIFIER ASSEMBLIES

Doorbell® High Voltage Stacking **N-136B**
Self-stacking rectifier modules are described and shown in numerous applications. Examples of circuits and mounting configurations are given.

Doorbell® Tube Replacement **N-130B**
The advantages of using rectifier modules to replace tubes are discussed. Case histories are noted and advice is given relating to module selection and installation. Pertinent ratings and other information is presented in tabular form, and outlines are shown for standard caps and bases.

Doorbell® is a registered trademark of Unitrode Corporation

SUBJECT — **PUBLICATION**

RECTIFIERS

The Importance of Rectifier Characteristics in Switching Power Supply Design **U-73**
The design of efficient switching power supplies is dependent upon the proper choice of rectifiers which in turn effect switching transistor reliability and performance, power supply efficiency and radio frequency interference. Significant rectifier characteristics and the transistor-rectifier relationship are discussed.

The Unitrode Schottky Rectifier — A New Design Tool for Switching Power Supply Engineers **DN-7**

TRANSIENT VOLTAGE SUPPRESSORS/ZENERS

Guidelines for Using Transient Voltage Suppressors **U-79**
This application note describes TVS characteristics, how to select the appropriate TVS and how to estimate pulse power levels. Applying the TVS to specific problem areas is explained using examples, and the use of alternative devices is discussed.

THYRISTORS

Thyristor New Design Ideas .... **NDI**
Approximately two dozen SCR circuits are shown and described. They represent applications which have generated interest or questions, as they are either popular, problematic or have unusual performance.

Power Switching Capabilities of Improved TO-92 Thyristors **U-78**
The performance and application advantages of Unitrode's 2N6681-85 Series is discussed. Due to their improved construction techniques, these devices exhibit considerable thermal management advantages when compared to other TO-92 Thyristors commonly used. Various high power switching circuits are given as examples.

Using ChipStrate Thyristors as Crowbars **DN-10**

SWITCHING REGULATORS

Switching Regulator Design Guide **U-68A**
New insight into the design of optimized switching regulators is presented. Practical circuits are shown and important factors are considered. A fast simple method is given to design the power inductor and select the optimum transistor, diode and other components.

Operating Switching Regulator Output Stages in Parallel **U-72**
Three methods to increase the output current capability of switching regulators are discussed. Waveforms show transient and "steady-state" current sharing. Analysis shows the reasons that one method is clearly preferred.

Flyback and Boost Switching Power Supplies **U-76**
This application note provides complete information for designing flyback or boost type switching power supplies. The design equations are derived using a graphic method to determine the parametric values for key elements of power switching regulator stage. Design examples are provided using PIC 600 series and TL 497 integrated circuits.

Minimizing Storage Time When Using Unitrode Switching Regulator Power Output Circuits **DN-3**

Avoiding Spurious Oscillation When Using Unitrode Switching Regulator Power Output Circuits **DN-4**

Operating the Switching Regulator Output Circuit at Low Frequencies **DN-6**

A 350 Watt Switching Regulated Output Power Supply for Multiple Outputs Utilizing Unitrode Semiconductors Components. **DN-8**

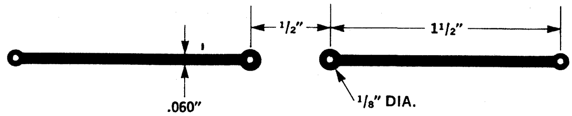
THERMAL DESIGN CONSIDERATIONS

For Lead Mounted Rectifiers and Zeners, for 5 types of mounting.

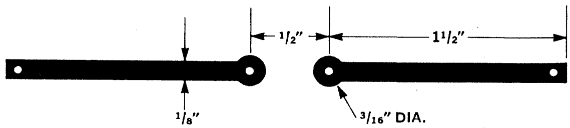
Determining The Power Rating for Your Application.
The information given in this section is presented for straight-forward use by the designer. The value given in this table is $R_{\theta JA}$, the "Total" thermal resistance of the diode and mounting together; no other graphs or tables are needed.

$$P_{max} = \frac{T_{Jmax} - T_{Amax}}{R_{\theta JA}}$$

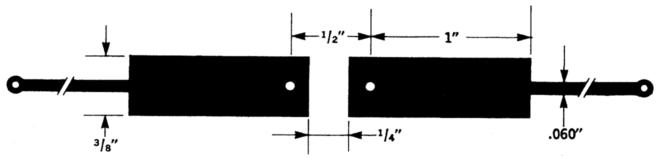
Where: P_{max} is the maximum power that can be dissipated in the device reliably. T_{Jmax} is the maximum of the operating temperature range, usually 175°C, unless derated for a military or hi rel application.
T_{Amax} is the max temp that the ambient reference (air below the device) will reach during operation.
Alternately,
Junction Temp Rise $= PR_{\theta JA}$



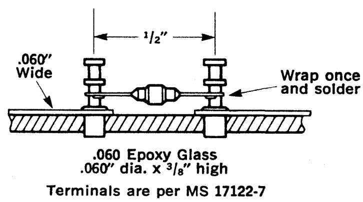
TYPE 1 PC BOARD, LIGHT



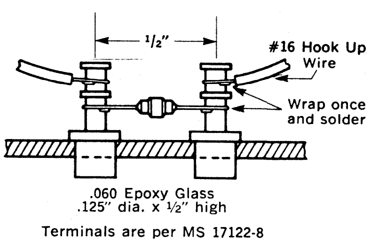
TYPE 2 PC BOARD, MEDIUM



TYPE 3 PC BOARD, HEAVY



TYPE 4 PC BOARD WITH CHESSMEN TERMINALS



TYPE 5 TERMINALS AND HOOK-UP WIRES

$R_{\theta JA}$ Total Thermal Resistance in Degrees C/Watt					
	Mounting Type				
Type	1	2	3	4	5
1N3611-3614	105	92	75	97	65
1N4245-4249	105	92	75	97	65
1N4461-4489	105	92	75	97	65
1N4736-4764	140	127	110	132	100
1N4942-4946	98	85	68	90	58
1N4954-4996 1	75	62	45	67	35
1N5063-5117	94	81	64	86	54
1N5186-5189	75	62	45	67	35
1N5186-5190	72	59	42	64	32
1N5550-5553	75	62	45	67	35
1N5614-5622	93	80	63	85	53
1N5802-5806	94	81	64	86	54
1N5807-5811	75	62	45	67	35
TVS 505-528	75	62	45	67	35
UES1101-1106	94	81	64	86	54
UES1301-1306	75	62	45	67	35
UR105-125	142	129	112	134	102
UR205-225	98	85	68	90	58
UT236-347	127	114	97	119	87
UT249-363	110	97	80	102	70
UT251-364	105	92	75	97	65
UT261-268	98	85	68	90	58
UT2005-2060	97	84	67	89	57
UT3005-3060	85	72	55	77	45
UT4005-4060	80	67	50	73	40
UTR01-61	127	114	97	119	87
UTR02-62	98	85	68	90	58
UTR10-60	176	163	146	168	136
UTR2305-2360	97	84	67	89	57
UTR3305-3360	85	72	55	77	45
UTR4305-4360	80	67	50	72	40
UTX105-125	142	129	112	134	102
UTX205-225	98	85	68	90	58
UTX3105-3120	85	72	55	77	45
UTX4105-4120	80	67	50	72	40
UZ706-140	94	81	64	86	54
UZ4706-4120	75	62	45	67	35
UZ5706-5140	75	62	45	67	35
UZ7706L-7710L	73	60	43	65	33
UZ8706-8120	140	127	110	132	100
UZS 306-440	94	81	64	86	54

PACKAGING DATA (Rectifiers & Zener Diodes)

LEAD MATERIALS

Unitrode offers a wide choice of lead materials for soldering or welding because the leads are attached to the pins outside the glass seal. Since the leads do not pass through a glass-to-metal seal, there is no need to match the thermal coefficient of expansion of the leads to the glass.

Solderable Leads — Silver plated copper is the standard lead material. These leads meet the solderability requirements of MIL-STD-202C Method 208A.

Solid silver leads meeting the requirements of MIL-S-13282 Grade A are available on special order.

Weldable Leads — Three types are available to meet the welding requirements of MIL-STD-1276A. The pure grade A nickel leads meet the requirements of type N-1. The gold-plated nickel leads meet the requirements of type N-2. Gold-plating is in accordance with MIL-G-45204, Type 1.

The copper leads (tin-coated) meet the requirements of type C. Types N-2 and C are solderable as well as weldable.

The following table lists standard lead lengths and materials. Weights of the diodes with various leads are also shown. In the event other lead materials are required, please consult Unitrode.

Body	Material	Usage	Lead Length (in.)	Lead Dia. (in.)	Suffix Letter	Typical Weight Body Plus Leads (mg)
A	Silver plated Copper (standard)	Solderable	1.0	.028	None	260
A	Silver	Solderable	0.7	.028	M	215
A	Copper, tinned	Solderable or weldable	1.0	.028	S	260
A	Nickel-clad copper gold-plated	Solderable or weldable	0.7	.030	Z	215
A	Nickel-clad copper	Weldable	0.7	.030	X	215
A	Nickel, gold-plated	Solderable or weldable	1.0	.020	V	165
A	Nickel	Weldable	1.0	.020	W	165
A	Copper, tinned	Solderable or weldable	1.0	.020	R	165
B AND C	Silver plated Copper (standard)	Solderable	1.0	.040	None	740
B AND C	Silver	Solderable	1.0	.040	P	740
B AND C	Copper, tinned	Solderable or weldable	1.0	.040	Q	740
B AND C	Nickel-clad copper gold-plated	Solderable or weldable	0.7	.030	Z	500
B AND C	Nickel-clad copper	Weldable	0.7	.030	X	500

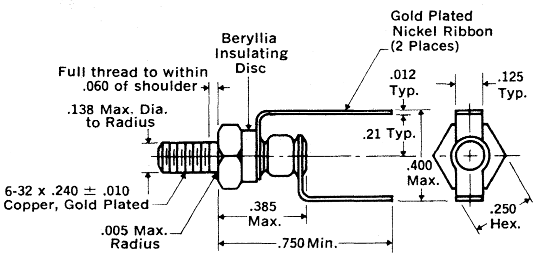
ORDERING INFORMATION

Optional lead materials can be ordered by adding the appropriate suffix letter to the part number. Example: UZ806Z would be UZ806 with gold-plated nickel-clad copper leads.

INSULATED STUD PACKAGES

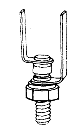
Unitrode's three stud-mounted devices, 10W high-surge zener diodes, 12A standard recovery rectifiers, and 9A fast-recovery rectifiers, are also available as shown here with insulated studs having the same high ratings as the standard non-insulated devices.

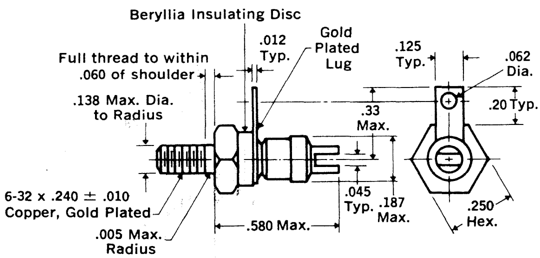
MECHANICAL SPECIFICATIONS



Dimensions in inches.

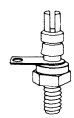
Style W





Dimensions in inches.

Style V



Part Identification: Style W: Part number printed on ribbon lead. Style V: Part number printed on body. Numerals are unique and indicate 10W Zener Series (UZ), 12A rectifier series (UT), or 9A fast-recovery rectifier series (UTR).
Polarity: Cathode to stud end.
Max. Weight: Styles W & V: 2.3 grams.
Installation Precautions: Maximum unlubricated stud torque: 36 inch-ounces.
Note: Do not use a screwdriver in turret slot for installation purposes, or damage may result.

ORDERING INFORMATION

The type numbers that apply to the standard studs also apply to the insulated studs with the addition of suffix W or V for style W or V (see outline drawings). For example, to specify insulated stud style W for a 6.8V zener, order UZ7806W; for a 50V 12A rectifier, order UT8105W; and for a 100V 9A fast-recovery rectifier, order UTR6410W.

V. PRODUCT DATA SHEETS

DIODE

Military Approved
Low Current

JAN & JANTX 1N483B
JAN & JANTX 1N485B

FEATURES

- Metallurgical Bond
- Qualified to MIL-S-19500/118
- Planar Passivated Chip
- DO-7 Package

DESCRIPTION

This Series is useful in low current rectifying applications for military equipment.

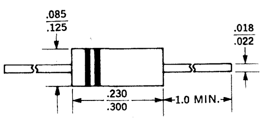
ABSOLUTE MAXIMUM RATINGS, AT 25°C

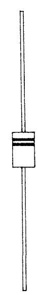
	1N483B	1N485B
Reverse Breakdown Voltage	80V	200V
Peak Working Voltage	70V	180V

Average Output Current @ $T_A = 25°C$ 200mA
$T_A = 150°C$ 50mA
Current Derating 1.2 mAdc/°C from 25°C to 150°C and 1.0 mAdc/°C from 150°C to 200°C
Surge Current, 8.3mSec .... 2 Amps
Operating Temperature Range .... −65°C to +200°C
Storage Temperature Range .... −65°C to +200°C

MECHANICAL SPECIFICATIONS

J & JTX 1N483B, 1N485B

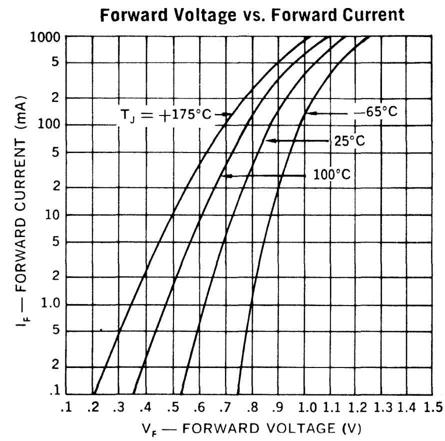


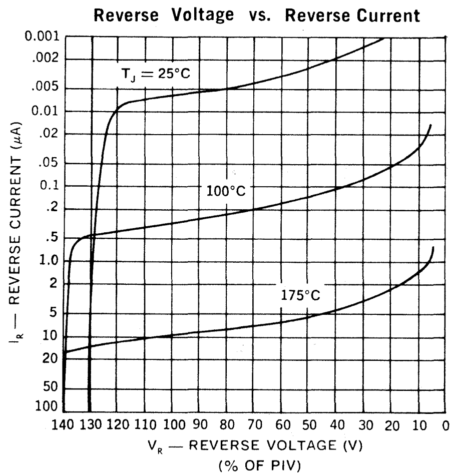


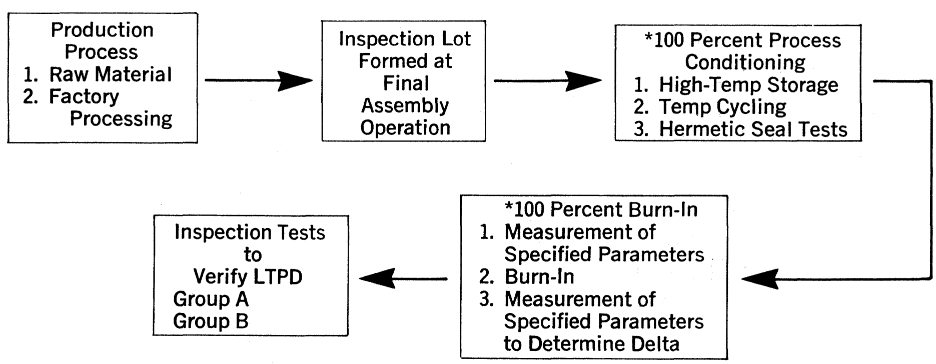
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Reverse Current @ 25°C	Reverse Current @ 25°C	Reverse Current @ 150°C	Forward Voltage @ 100mAdc, 8.5msec dc = 2% MAX.
1N483B	25nA @ 70Vdc	100 μA(pk) @ 80V(pk)	5.0 μA @ 70Vdc	1.0V(pk)
1N485B	25nA @ 180Vdc	100 μA(pk) @ 200V(pk)	5.0 μA @ 180Vdc	







*Order of the tests in the blocks shall be performed as shown.

Order of procedure diagrams for TX types only.

UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

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RECTIFIERS

Military Approved
High Voltage, Low Current

JAN, JANTX & JANTXV 1N645
JAN, JANTX & JANTXV 1N645-1

FEATURES
- Metallurgical Bond
- Qualified to MIL-S-19500/240
- Planar Passivated Chip
- DO-35 or DO-7 Package

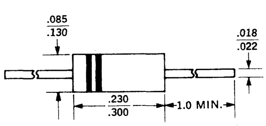
DESCRIPTION
These devices are useful in general purpose low current applications in high reliability and military equipment.

ABSOLUTE MAXIMUM RATINGS, AT 25°C

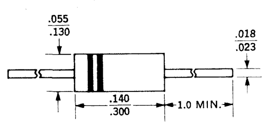
Reverse Breakdown Voltage	270V
Peak Working Voltage	225V
Average Output Current, 25°C	400mA
150°C	150mA
Surge Current, 8.3msec	5A
Operating Temperature Range	−65°C to + 150°C
Storage Temperature Range	−65°C to + 200°C

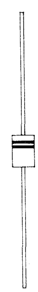
MECHANICAL SPECIFICATIONS

J, JTX & JTXV 1N645



J, JTX, & JTXV 1N645-1



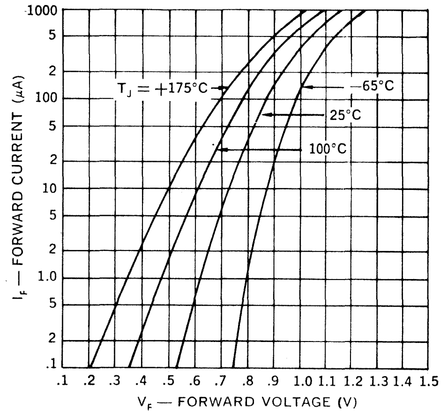


UNITRODE

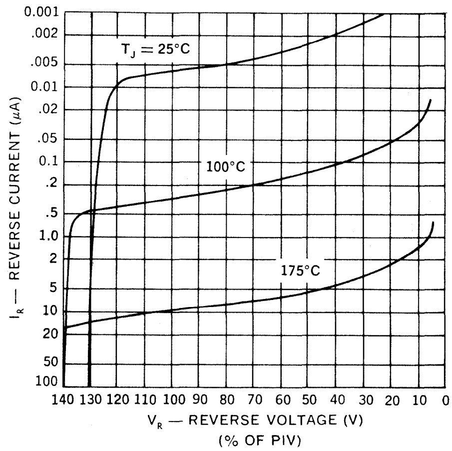
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

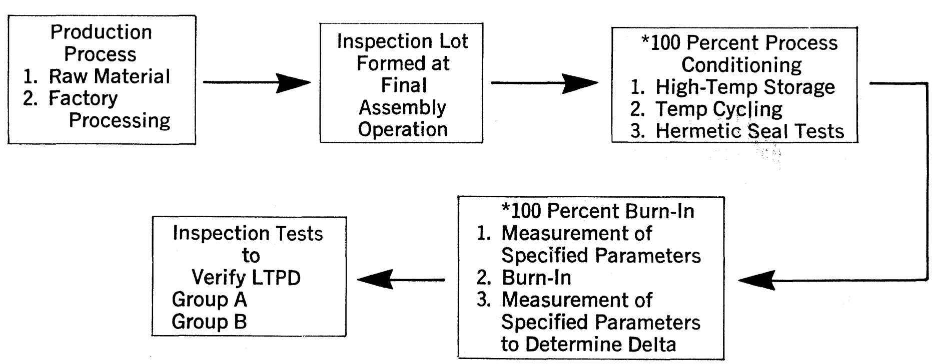
Type	Reverse Current @ 25°C	Reverse Current @ 50°C	Peak Reverse Current @ 25°C	Average Reverse Current @ 150°C	Forward Voltage @ 25°C	Capacitance
1N645	0.025μA @ 225Vdc	15μAdc @ 225Vdc	100μA (pk) @ 270V (pk)	100μAdc @ 225V (pk)	1.0Vdc @ $I_F = 400$mAdc 8.3msec	20 pf $V_R = 4$ Vdc f = 1 MHz $V_{sig} = 50$ mV
1N645-1	0.050μA @ 225Vdc	25μAdc @ 225Vdc	100μA (pk) @ 270V (pk)	100μAdc @ 225V (pk)	1.0Vdc @ $I_F = 400$mAdc 8.3msec	20 pf $V_R = 4$ Vdc f = 1 MHz $V_{sig} = 50$ mV

Forward Voltage vs. Forward Current



Reverse Voltage vs. Reverse Current





*Order of the tests in the blocks shall be performed as shown.

Order of procedure diagrams for TX types only.

COMPUTER DIODE
Military Approved

JAN, JANTX, JANTXV 1N914
JAN, JANTX, JANTXV 1N4148
JAN, JANTX, JANTXV 1N4148-1

FEATURES
- Metallurgical Bond
- Qualified to MIL-S-19500/116
- Planar Passivated Chip
- DO-35 Package

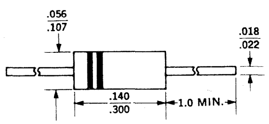
DESCRIPTION
This series is very popular for general purpose switching applications in military equipment.

ABSOLUTE MAXIMUM RATINGS, AT 25°C

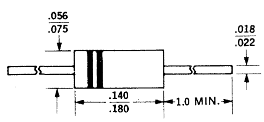
Reverse Breakdown Voltage		100V
Peak Working Voltage		75V
Average Output Current,	1N914	75mAdc
	1N4148	200mAdc
	1N4148-1	150mAdc
Surge Current, 8.3msec		500mA
Operating Temperature Range		−65°C to +175°C
Storage Temperature Range		−65°C to +200°C

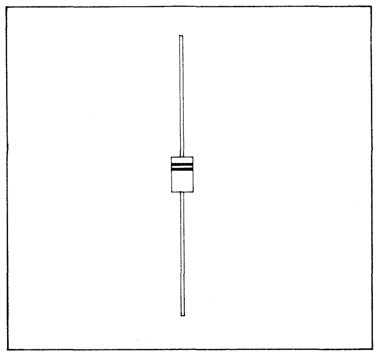
MECHANICAL SPECIFICATIONS

J, JTX & JTXV 1N914



J, JTX & JTXV 1N4148, 1N4148-1



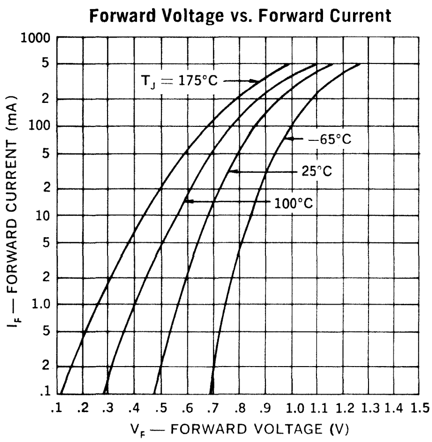


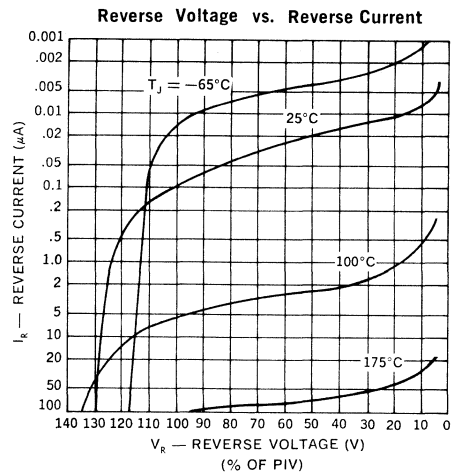
UNITRODE

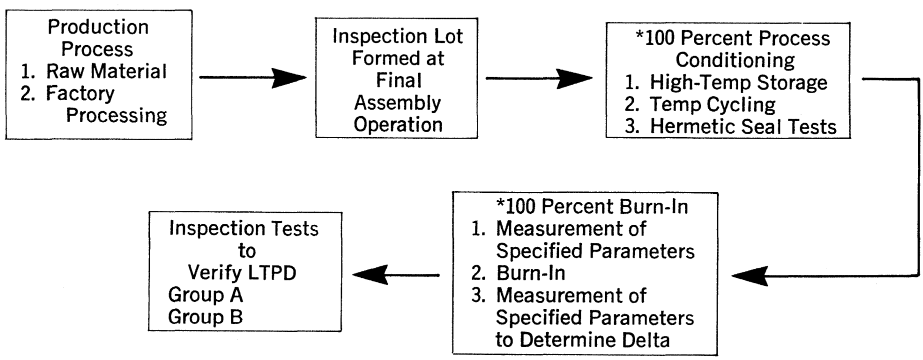
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Reverse Current @ 25°C	Reverse Current @ 25°C	Peak Reverse Current @ 25°C	Reverse Current @ 150°C	Reverse Current @ 150°C
25nAdc @ $V_R = 20Vdc$	5.0μAdc @ $V_R = 75Vdc$	100μA (pk) @ $V_R = 100V$ (pk)	50μAdc @ $V_R = 20Vdc$	100μAdc @ $V_R = 75Vdc$

Forward Voltage	Foward Recovery Voltage	Forward Recovery Time	Reverse Recovery Time	Capacitance
1.0Vdc @ $I_F = 10mAdc$	5.0V (pk) @ $I_F = 50mAdc$	20nsec @ $I_F = 50mAdc$	5nsec @ $I_F = I_R = 10mA$ $R_L = 100$ ohms	4.0 pf @ $V_R = 0V$, f = 1 MHz $V_{sig} = 50mV$ (pk-pk) 2.8 pf @ $V_R = 1.5V$, f = 1 MHz $V_{sig} = 50mV$ (pk-pk)







*Order of the tests in the blocks shall be performed as shown.

Order of procedure diagrams for TX types only.

RECTIFIERS
Military Approved, 35 Amp, Standard Recovery

JAN, JANTX 1N1184
JAN, JANTX 1N1186
JAN, JANTX 1N1188

FEATURES:
- Qualified to MIL-S-19500/297
- High Mechanical Integrity
- Low Thermal Resistance
- JAN and JANTX Available

DESCRIPTION:
This series of military approved rectifiers is useful in many military applications. These devices feature unique mechanical ruggedness combined with high current characteristics.

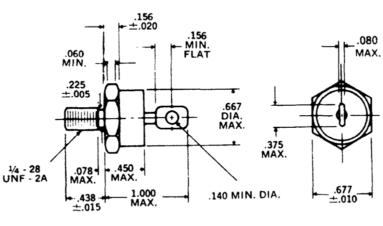
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
100V	JAN, JANTX 1184
200V	JAN, JANTX 1186
400V	JAN, JANTX 1188

Maximum Average D.C. Output Current
@ $T_C = 150°C$ 35A
Non Repetitive Sinusoidal Surge Current
@ $T_C = 150°C$ 500A
Operating Temperature .... $T_C = -65°C$ to $+150°C$
Storage Temperature .... $T_C = -65°C$ to $+175°C$

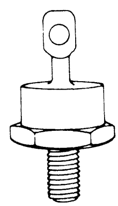
MECHANICAL SPECIFICATIONS

JAN, JANTX 1N1184, 1N1186, 1N1188



Dimensions in inches.

DO-5



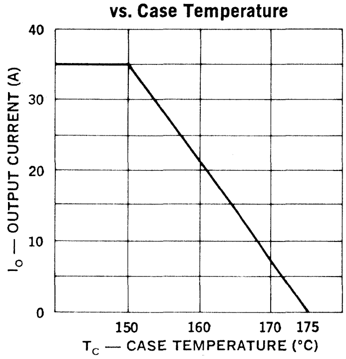
Notes:
1. Polarity is cathode-to-stud.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

UNITRODE

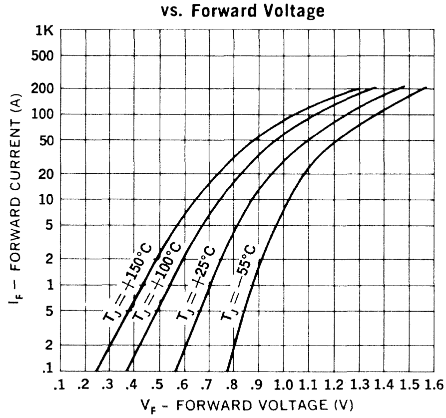
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Leakage Current @ PIV	
			25°C	150°C
J, JTX 1N1184 J, JTX 1N1186 J, JTX 1N1188	100V 200V 400V	1.4V(pk) @ $I_f = 110A(pk)$ $t_p \leqslant 8.3ms$ $d_C \leqslant 2\%$	250μA	3mA

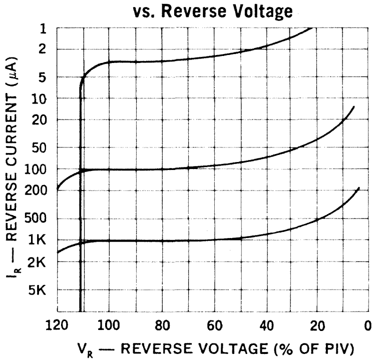
Output Current vs. Case Temperature



Forward Current vs. Forward Voltage



Typical Reverse Current vs. Reverse Voltage



COMPUTER DIODE

Military Approved Switching

JAN & JANTX 1N3064
JAN & JANTX 1N4454
JAN & JANTX 1N4454-1

FEATURES

- Metallurgical Bond
- Qualified to MIL-S-19500/144
- Planar Passivated Chip
- DO-7 or DO-35 Package

DESCRIPTION

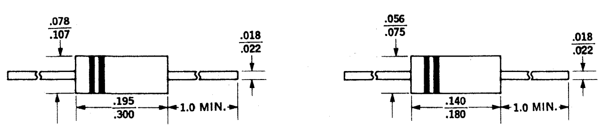
Available in either DO-35 or DO-7 package. Unitrode offers high temperature metallurgical bond, making these devices useful in high reliability applications.

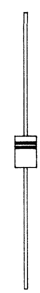
ABSOLUTE MAXIMUM RATINGS, AT 25°C

Reverse Breakdown Voltage		75V
Peak Working Voltage		50V
Average Output Current,	1N3064	75mA
	1N4454,-1	200mA
Surge Current, 1sec	1N3064	0.5A
	1N4454,-1	1.0A
Operating Temperature Range		−65°C to +175°C
Storage Temperature Range		−65°C to +200°C

MECHANICAL SPECIFICATIONS

J & JTX 1N3064 | J & JTX 1N4454, 1N4454-1





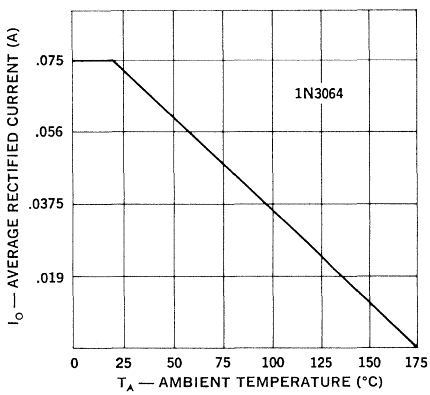
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

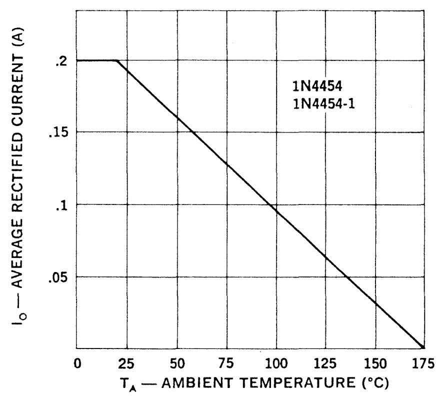
Type	Reverse Current @ 25°C	Reverse Current @ 150°C	Reverse Breakdown Voltage @ −65°C	Reverse Recovery Time	Capacitance
1N3064 1N4454 1N4454-1	0.1μAdc @ $V_R = 50V$	100μAdc @ $V_R = 50V$	75Vdc @ $I_R = 10\mu Adc$	4nsec @ $I_F = I_R = 10mAdc$ $R_L = 100$ ohms $c \leqslant 3pf$	2.0pf @ $V_R = 0$ Vdc, f = 1 MHz $V_{sig} = 50mV$ (pk to pk)

Forward Voltage	Forward Recovery Voltage	Forward Recovery Time
1.0 Vdc @ $I_F = 10mAdc$	5.0V (pk) @ $I_F = 100mAdc$ $t_r \leqslant 0.4nsec$	30nsec $I_F = 100mAdc$ $t_r \leqslant 0.4nsec$

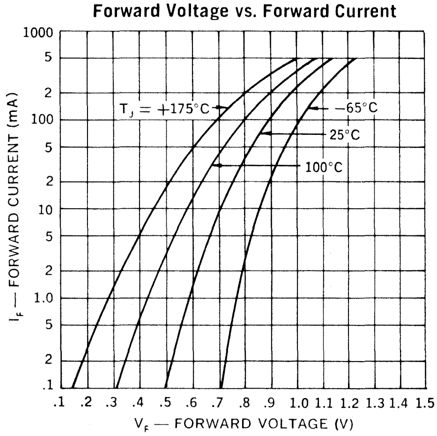
Average Rectified Current vs. Ambient Temperature



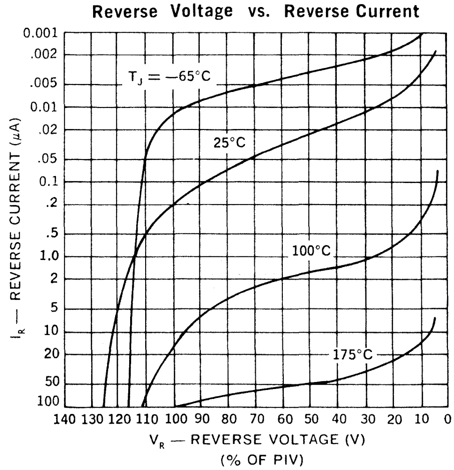
Average Rectified Current vs. Ambient Temperature



Forward Voltage vs. Forward Current



Reverse Voltage vs. Reverse Current



COMPUTER DIODE
Military Approved
Low Power, Switching

JAN, JANTX & JANTXV 1N3600
JAN, JANTX & JANTXV 1N4150
JAN, JANTX & JANTXV 1N4150-1

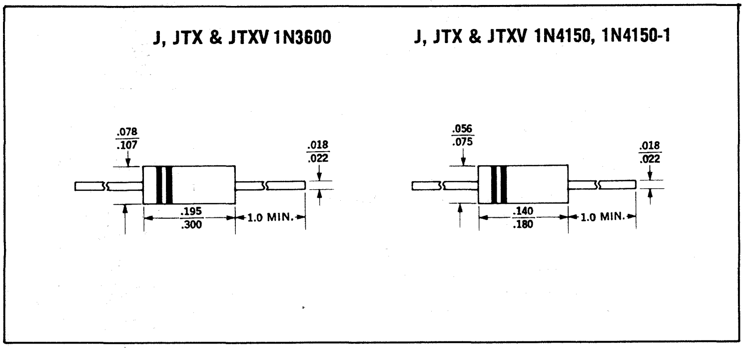
FEATURES
- Metallurgical Bond
- Qualified to MIL-S-19500/231
- Planar Passivated Chip
- DO-7 or DO-35 Package

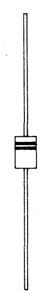
DESCRIPTION
This series of switching diodes is useful in many computer switching applications.

ABSOLUTE MAXIMUM RATINGS, AT 25°C

Reverse Breakdown Voltage	75V
Peak Working Voltage	50V
Average Output Current	200mA
Surge Current (1sec)	0.5A
(1μsec)	4.0A
Operating Temperature Range	−65°C to +175°C
Storage Temperature Range	−65°C to +200°C

MECHANICAL SPECIFICATIONS





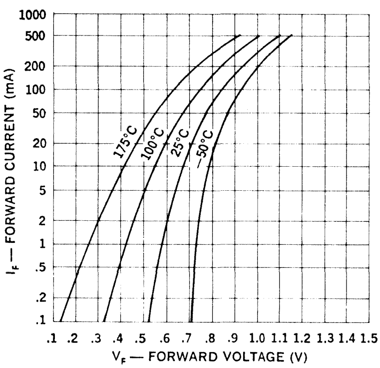
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

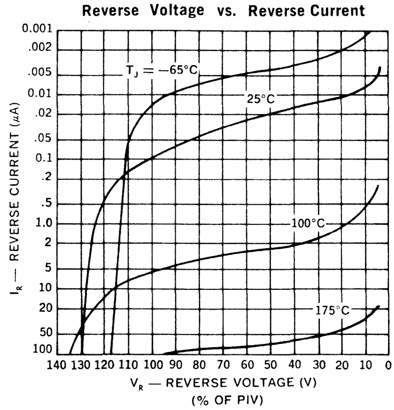
Characteristics	Forward Voltage	Forward Voltage	Forward Voltage	Forward Voltage	Forward Voltage	Reverse Breakdown Voltage
Conditions	V_{F1} $I_F = 1$ mAdc	V_{F2} $I_F = 10$ mAdc	V_{F3} $I_F = 50$ mAdc (pulse)	V_{F4} $I_F = 100$ mAdc (pulse)	V_{F5} $I_F = 200$ mAdc (pulse)	BV $I_R = 5.0\ \mu$Adc
Minimum Maximum	0.540 Vdc 0.620 Vdc	0.660 Vdc 0.740 Vdc	0.760 Vdc 0.860 Vdc	0.820 Vdc 0.920 Vdc	0.870 Vdc 1.00 Vdc	75 Vdc —

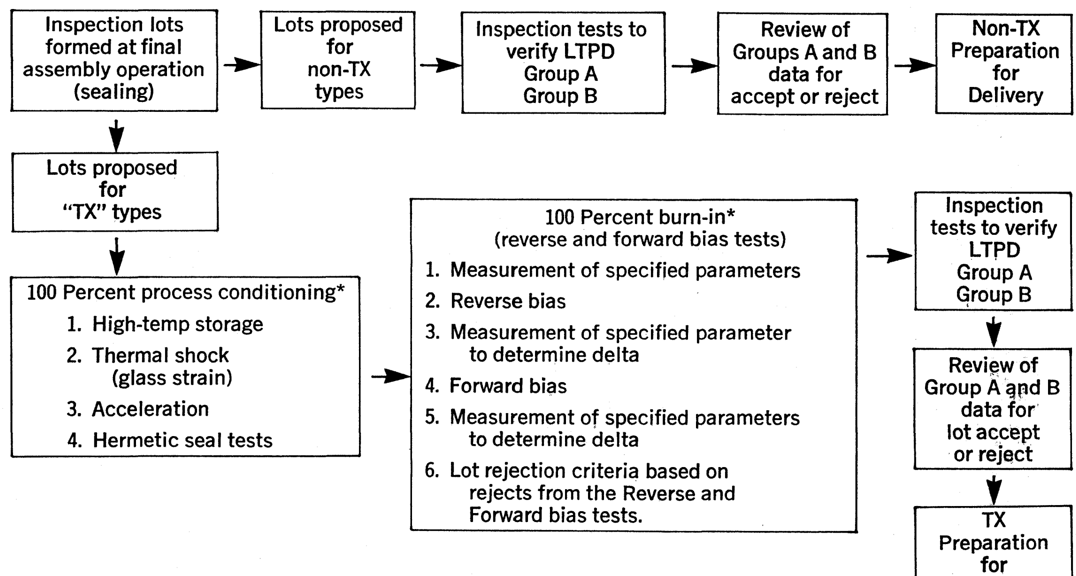
Characteristics	Reverse Current	Reverse Current	Junction Capacitance	Reverse Recovery Time	Reverse Recovery Time	Forward Recovery Time
Conditions	I_R $V_R = 50$ Vdc	I_R $V_R = 50$ Vdc $T_A = 150°C$	C $V_R = 0$ F = 1 MHz $V_{sig} = 50$ mv (p-p)	t_{rr1} $I_F = I_R =$ 10 to 200 mAdc; $R_L = 100$ ohms	t_{rr2} $I_F = I_R =$ 200 to 400 mAdc; $R_L = 100$ ohms	t_{fr} $I_F = 200$ mAdc; $t_p = 100$ nsec; $t_r = 0.4$ nsec
Maximum	0.1 μAdc	100 μAdc	2.5 pf	4 nsec	6 nsec	10 nsec

Typical Forward Current vs Voltage



Reverse Voltage vs. Reverse Current





Order of procedure diagram for non-TX and "TX" types.

RECTIFIERS

Military Approved, 1 Amp, General Purpose

JAN & JANTX 1N3611-1N3614

FEATURES

- Qualified to MIL-S-19500/228
- Continuous Rating: 1A
- Surge Rating: 30A
- PIV: to 800V

DESCRIPTION

This series of MIL approved JAN and JANTX general purpose 1 amp rectifiers are useful in many high rel applications.

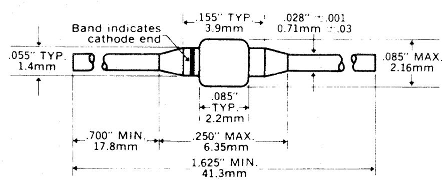
ABSOLUTE MAXIMUM RATINGS

Peak Reverse Voltage Min.	Reverse Working Voltage	Type
240V	200V	JAN & JANTX 1N3611
480V	400V	JAN & JANTX 1N3612
720V	600V	JAN & JANTX 1N3613
920V	800V	JAN & JANTX 1N3614

Maximum Average D.C. Output Current
@ $T_A = 100°C$ 1.0A
@ $T_A = 150°C$ 0.3A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 30A
Operating Temperature Range .... —65°C to +175°C
Storage Temperature Range .... —65°C to +200°C
Thermal Resistance .... See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX1N3611-1N3614



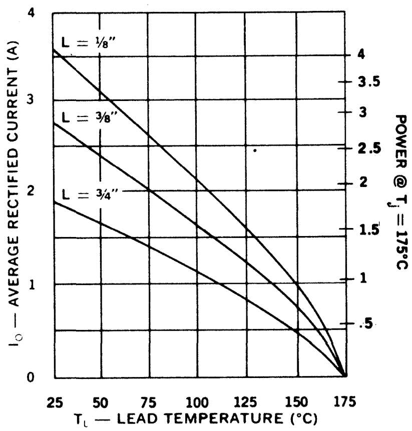
BODY A

UNITRODE

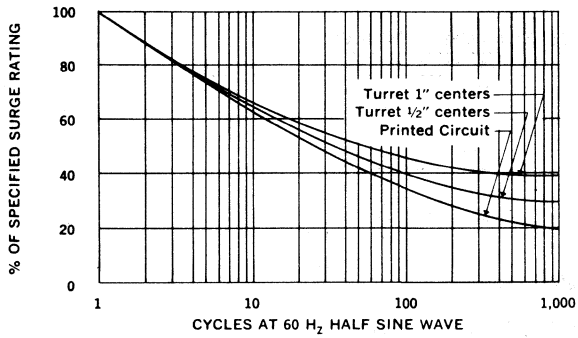
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Reverse D.C. Voltage	Minimum Reverse Breakdown Voltage @ 100μA	Peak Forward Voltage Min.	Peak Forward Voltage Max.	Maximum D.C. Reverse Current at D.C. Voltage 25°C	Maximum D.C. Reverse Current at D.C. Voltage 150°C
JAN & JANTX 1N3611	200V	240V	0.6V	1.1V(pk) @ 1.0A	1μA	300μA
JAN & JANTX 1N3612	400V	480V				
JAN & JANTX 1N3613	600V	720V				
JAN & JANTX 1N3614	800V	920V				

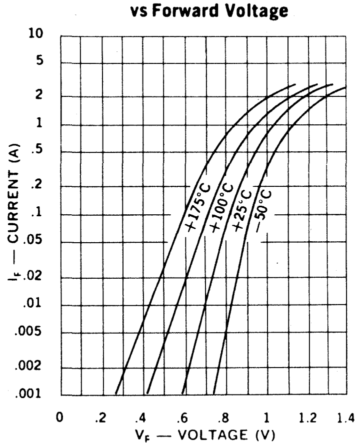
Maximum Current vs Lead Temperature



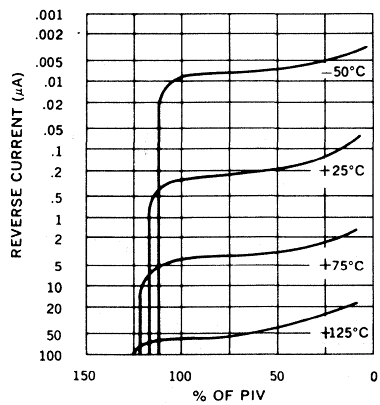
Allowable Forward Surge vs Number of Cycles



Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



RECTIFIERS

Military Approved, Fast Recovery, 30A

JAN, JANTX 1N3909
JAN, JANTX 1N3910
JAN, JANTX 1N3911
JAN, JANTX 1N3912
JAN, JANTX 1N3913

FEATURES

- Qualified to MIL-S-19500/308
- High Mechanical Integrity
- Low Thermal Resistance
- JAN and JANTX Available

DESCRIPTION

These devices feature unique mechanical ruggedness combined with fast switching electrical characteristics. Devices may be used in many power switching circuits.

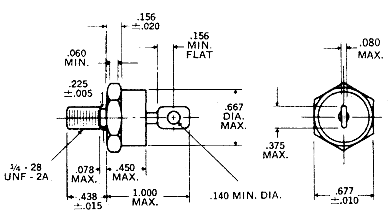
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	JAN, JANTX 1N3909
100V	JAN, JANTX 1N3910
200V	JAN, JANTX 1N3911
300V	JAN, JANTX 1N3912
400V	JAN, JANTX 1N3913

Maximum Average D.C. Output Current
@ $T_C = 100°C$ 30A
Non Repetitive Sinusoidal Surge Current
@ $T_C = 100°C$ 300A
Thermal Resistance, Junction-to-Case .... 1.2°C/W
Operating Temperature .... $T_C = -65°C$ to $+150°C$
Storage Temperature .... $T_C = -65°C$ to $+175°C$

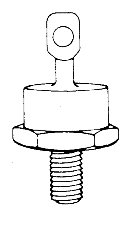
MECHANICAL SPECIFICATIONS

JAN, JANTX 1N3909, 1N3910, 1N3911, 1N3912, 1N3913



Dimensions in inches.

DO-5



Notes:

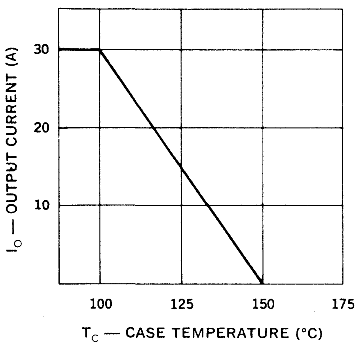
1. Polarity is cathode-to-stud.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

UNITRODE

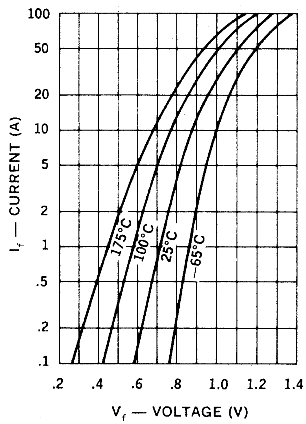
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time $I_F = 1A$, $V_R = 30V$
			25°C	100°C	
J, JTX 1N3909 J, JTX 1N3910 J, JTX 1N3911 J, JTX 1N3912 J, JTX 1N3913	50V 100V 200V 300V 400V	1.4V(pk) @ $I_f = 95Apk$ $t_p \leqslant 8.3ms$ $d_C \leqslant 2\%$	80μA	10mA	200 nsec

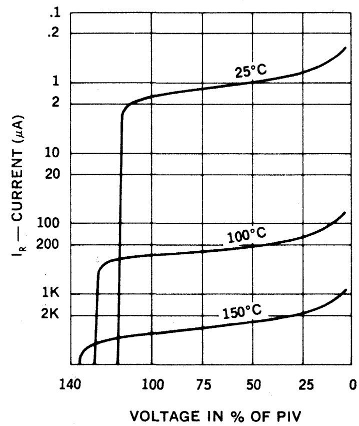
Output Current vs. Case Temperature



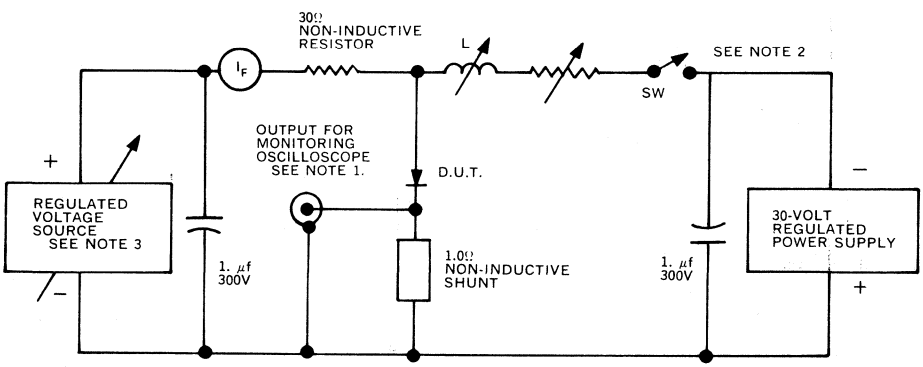
Typical Forward Current vs. Forward Voltage



Typical Reverse Current vs. Voltage



Reverse-Recovery Circuit



NOTES:

1. Monitoring oscilloscope requirements: $t_r \leqslant 14$ nsec, $R_{in} \geqslant 9M\Omega$, $C_{in} \leqslant 12$ pF, L_{in} (series) $\leqslant 0.5$ μH.
2. SW characteristics: Mercury-wetted make-before-break relay switches at a 60 Hz rate. The relay should conduct for approximately 640 μsec and be open for approximately 7.7 msec. (C.P. Clare HGP 1004 or equivalent).
3. Voltage source characteristics: Output impedance $\leqslant 0.5\Omega$ from 0 to 2 Hz.

COMPUTER DIODE

Military Approved Switching Diode

JAN, JANTX & JANTXV 1N4153

FEATURES
- Metallurgical Bond
- Qualified to MIL-S-19500/337
- Planar Passivated Chip
- DO-35 Package

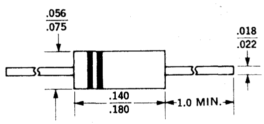
DESCRIPTION
This device is particularly suited to military applications where tightly controlled forward characteristics and fast recovery time are important.

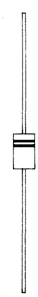
ABSOLUTE MAXIMUM RATINGS, AT 25°C

Reverse Breakdown Voltage	75V
Peak Working Voltage	50V
Average Output Current	150mA
Surge Current, 1μsec	2.0A
Operating Temperature Range	−65°C to +200°C
Storage Temperature Range	−65°C to +200°C

MECHANICAL SPECIFICATIONS

J, JTX & JTXV 1N4153





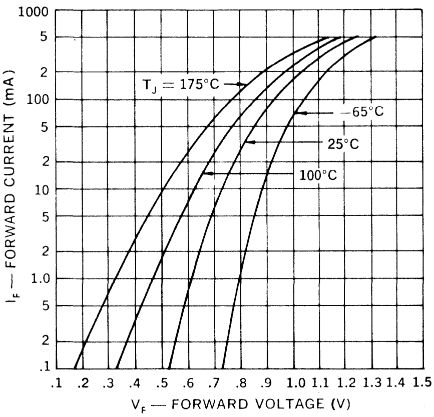
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

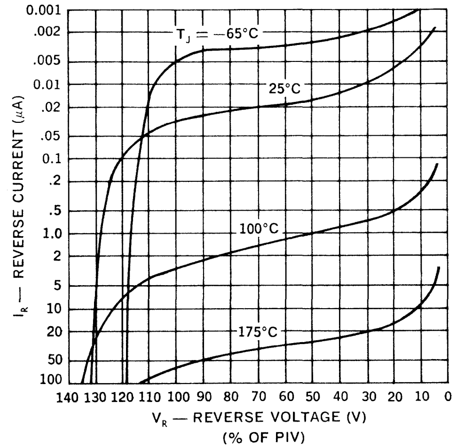
Limit	V_{F1} $I_F = 100\ \mu Adc$	V_{F2} $I_F = 250\ \mu Adc$	V_{F3} $I_F = 1$ mAdc	V_{F4} $I_F = 2$ mAdc	V_{F5} $I_F = 10$ mAdc	V_{F6} $I_F = 20$ mAdc
Min	0.490 Vdc	0.530 Vdc	0.590 Vdc	0.620 Vdc	0.700 Vdc	0.740 Vdc
Max	0.550 Vdc	0.590 Vdc	0.670 Vdc	0.700 Vdc	0.810 Vdc	0.880 Vdc

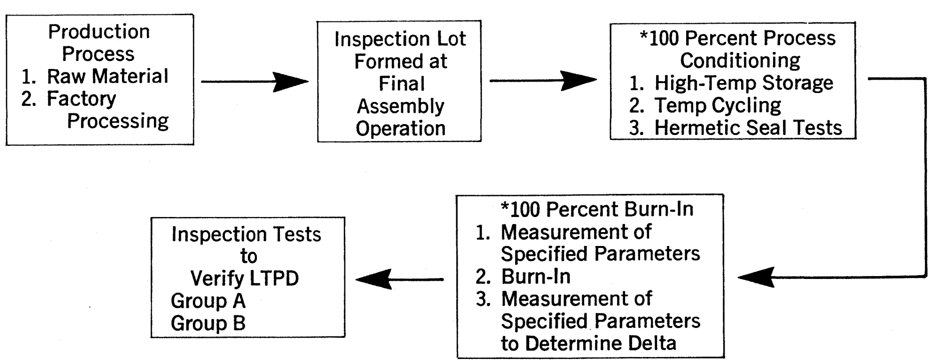
Limit	I_R $V_R = 50$ V	I_{R2} $V_R = 50$ V $T_A = 150$ C	C $V_R = 0$ f = 1 MHz	t_{rr} $I_F = I_R = 10$ mAdc $R_L = 100$ ohms	Reverse Breakdown Voltage $I_R = 5.0\ \mu Adc$
Min	—	—	—	—	75V
Max	0.05 μAdc	50 μAdc	2.0 pF	4 ns	—

Forward Voltage vs. Forward Current



Reverse Voltage vs. Reverse Current





*Order of the tests in the blocks shall be performed as shown.

Order of procedure diagrams for TX types only.

RECTIFIERS

Military Approved, 1 Amp, General Purpose

1N4245-1N4249 JAN, JANTX & JANTXV

FEATURES

- Qualified to MIL-S-19500/286
- Surge Rating: 25A
- PIV: to 1000 V
- Controlled Avalanche
- No Plastic, Epoxy, Silicone, Oxides, Gases or Solder are used

DESCRIPTION

This series of general purpose power rectifiers are available as JAN, JANTX or JANTXV for many power supply applicatons.

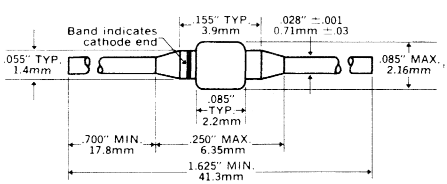
ABSOLUTE MAXIMUM RATINGS

Maximum Reverse Voltage	Type
200V	JAN, JANTX, JANTXV 1N4245
400V	JAN, JANTX, JANTXV 1N4246
600V	JAN, JANTX, JANTXV 1N4247
800V	JAN, JANTX, JANTXV 1N4248
1000V	JAN, JANTX, JANTXV 1N4249

Maximum Average D.C. Output Current
@ $T_A = 100°C$ 1.0A
@ $T_A = 150°C$ 0.333A
Non-Repetitive Sinusoidal Surge Current 25A
Operating Temperature Range .... —65°C to +175°C
Storage Temperature Range .... —65°C to +175°C
Thermal Resistance .... See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N4245-1N4249



BODY A

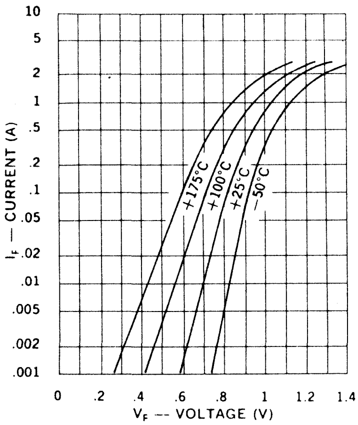
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

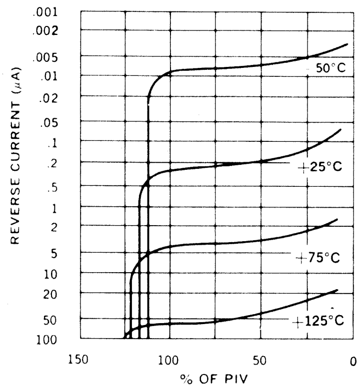
Type	PIV	Minimum Reverse Breakdown Voltage @ 100μA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
			Min.	Max.	25°C	150°C	
J, JTX, JTXV 1N4245	200V	240V	0.6V	1.3V(pk) @ 3.0A(pk)	1.0μA	150μA	5.0μs
J, JTX, JTXV 1N4246	400V	480V					
J, JTX, JTXV 1N4247	600V	720V					
J, JTX, JTXV 1N4248	800V	960V					
J, JTX, JTXV 1N4249	1000V	1150V					

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

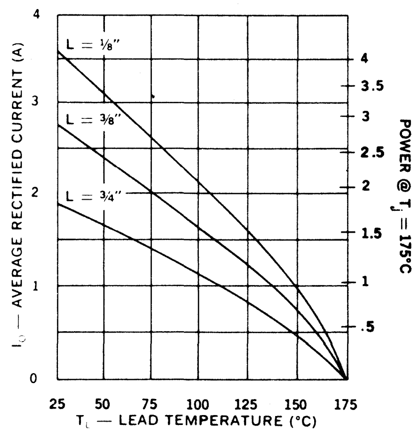
Typical Forward Current vs Forward Voltage



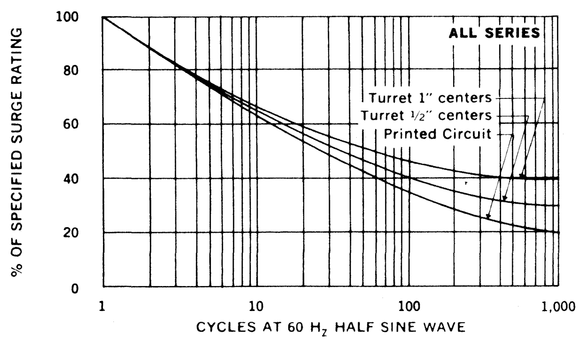
Typical Reverse Current vs PIV



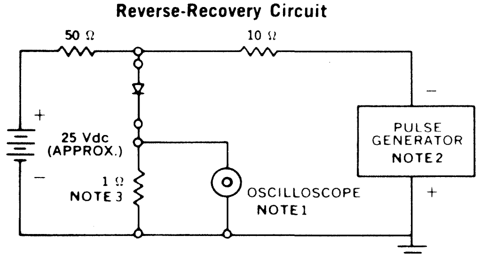
Maximum Current vs Lead Temperature



Allowable Forward Surge vs Number of Cycles



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time < 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time < 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

POWER ZENERS
1.5 Watt, Military

1N4461-1N4496
JAN, JANTX & JANTXV

FEATURES
- 5 Times Greater Surge Rating than JAN1N3016 Series
- Low Reverse Current: to 50nA
- ¼ Size of Conventional 1 Watt Zeners

DESCRIPTION

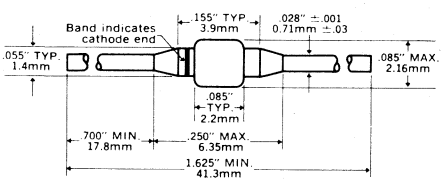
Fused-in-glass, metallurgically bonded 1.5 watt zeners, qualified to MIL-S-19500/406.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 200V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +175°C

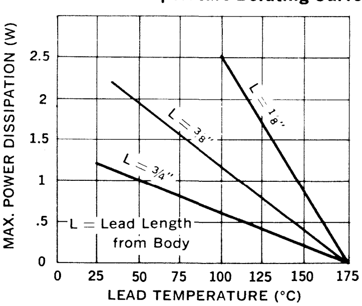
MECHANICAL SPECIFICATIONS

JAN, JANTX & JANTXV 1N4461-1N4496

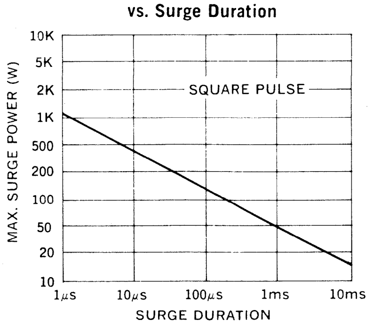


BODY A

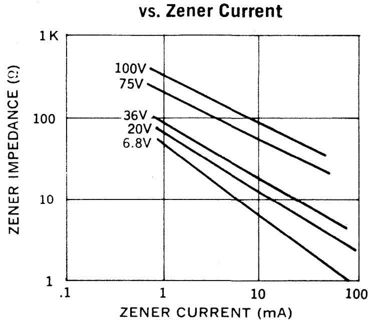
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Type	Electrical Specifications at 25°C: Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance §: Z_Z @ I_{ZT}	Z_{ZK} @ I_{ZK}	I_{ZK}	Voltage ** Regulation ΔBV Max	Maximum Reverse Leakage Current: I_R @ V_R	V_R	Maximum Ratings: Maximum Cont. Current I_{ZM}	Maximum Surge Current ‡ I_S
±5% Tolerance	Volts	mA	Ohms	Ohms	mA	Volts	µA	Volts	mA	Amps
1N4461	6.8	37	2.5	200	1.0	.30	5.0	4.08	210	5.0
1N4462	7.5	34	2.5	400	.5	.35	1.0	4.50	191	4.5
1N4463	8.2	31	3.0	400	.5	.40	.50	4.92	174	3.9
1N4464	9.1	28	4.0	500	.5	.45	.30	5.46	157	3.4
1N4465	10	25	5.0	500	.25	.50	.30	8.0	143	3.0
1N4466	11	23	6.0	550	.25	.55	.30	8.8	130	2.6
1N4467	12	21	7.0	550	.25	.60	.20	9.6	119	2.4
1N4468	13	19	8.0	550	.25	.65	.10	10.4	110	2.2
1N4469	15	17	9.0	600	.25	.75	.05	12.0	95	1.8
1N4470	16	15.5	10.0	600	.25	.80	.05	12.8	90	1.6
1N4471	18	14	11.0	650	.25	.83	.05	14.4	79	1.4
1N4472	20	12.5	12.0	650	.25	.95	.05	16.0	71	1.2
1N4473	22	11.5	14	650	.25	1.0	.05	17.6	65	1.1
1N4474	24	10.5	16	700	.25	1.1	.05	19.2	60	.90
1N4475	27	9.5	18	700	.25	1.3	.05	21.6	53	.80
1N4476	30	8.5	20	750	.25	1.4	.05	24.0	48	.75
1N4477	33	7.5	25	800	.25	1.5	.05	26.4	43	.66
1N4478	36	7.0	27	850	.25	1.7	.05	28.8	40	.60
1N4479	39	6.5	30	900	.25	1.8	.05	31.2	37	.54
1N4480	43	6.0	40	950	.25	1.9	.05	34.4	33	.48
1N4481	47	5.5	50	1000	.25	2.1	.05	37.6	30	.45
1N4482	51	5.0	60	1100	.25	2.3	.05	40.8	28	.42
1N4483	56	4.5	70	1300	.25	2.5	.05	44.8	26	.39
1N4484	62	4.0	80	1500	.25	2.7	.05	49.6	23	.35
1N4485	68	3.7	100	1700	.25	3.0	.05	54.4	21	.32
1N4486	75	3.3	130	2000	.25	3.3	.05	60.0	19	.29
1N4487	82	3.0	160	2500	.25	3.6	.05	65.6	17	.26
1N4488	91	2.8	200	3000	.25	4.0	.05	72.8	16	.23
1N4489	100	2.5	250	3100	.25	4.4	.25	80.0	14	.20
1N4490	110	2.0	300	4000	.25	5.0	.25	88.0	13	.19
1N4491	120	2.0	400	4500	.25	5.5	.25	96.0	12	.18
1N4492	130	1.9	500	5000	.25	6.0	.25	104	11	.16
1N4493	150	1.7	700	6000	.25	7.0	.25	120	9.5	.14
1N4494	160	1.6	1000	6500	.25	8.0	.25	128	8.9	.12
1N4495	180	1.4	1300	7000	.25	10.0	.25	144	7.9	.10
1N4496	200	1.2	1500	8000	.25	12.0	.25	160	7.2	.08

† All Zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60 cycle AC Voltage created when AC current with RMS value of 10% of DC Zener test current is superimposed on the test current.

** ΔBV is obtained by measuring the voltage change when the test current is changed from 10% to 50% of Iz max under DC conditions. During this measurement the leads are heat sunk .375 inch from the body and maintained at 25°C.

‡ Ratings shown are for peak sinusoidal surge current of 8.3 ms duration, non-repetitive. The 8.3 ms square pulse rating is 71% of the value shown. Rating exceeds JEDEC Registered Specification.

COMPUTER DIODE

Military Approved
Switching

JAN & JANTX 1N4500

FEATURES

- Metallurgical Bond
- Qualified to MIL-S-19500/403
- Planar Passivated Chip
- DO-35 Package

DESCRIPTION

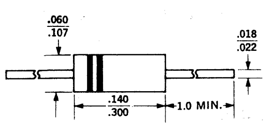
This device is a fast switching, high conductance diode for military, space and other high rel systems.

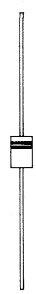
ABSOLUTE MAXIMUM RATINGS, AT 25°C

Reverse Breakdown Voltage	80Vdc
Peak Working Voltage	75Vpk
Average Output Current	300mAdc
Surge Current, 1sec	0.5A
1μsec	4.0A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C

MECHANICAL SPECIFICATIONS

J & JTX 1N4500





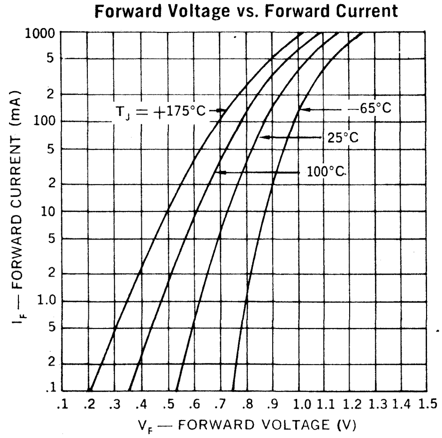
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

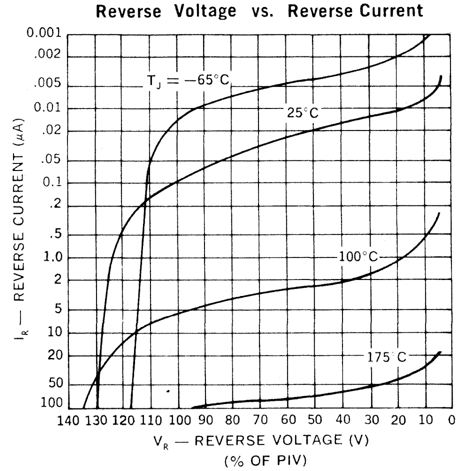
Limits	V_{F1} $I_F = 250\mu Adc$	V_{F2} $I_F = 1.0mAdc$	V_{F3} $_F = 10mAdc$	V_{F4} $I_F = 20mAdc$	V_{F5} 1/ $I_F = 300mAdc$	C $V_R = 0$ 100 kHz $\leqslant f \leqslant$ 1 MHz $v_{sig} = 50$ mv (p-p)
	mVdc	mVdc	mVdc	mVdc	Vdc	pF
Minimum	470	520	640	670	—	—
Maximum	560	600	720	770	1.10	4.0

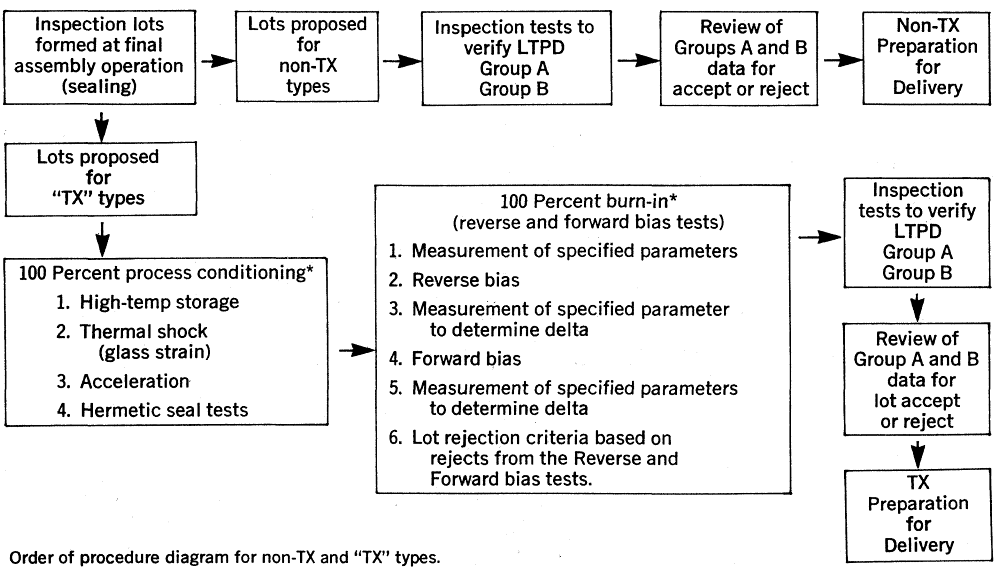
	I_R $V_R = 75Vdc$	B_V $I_R = 5\mu Adc$	I_R $V_R = 75Vdc$ $T_A = 150°C$	t_{rr} $I_F = I_R =$ 10 mAdc: $R_L = 100$ ohms
	nAdc	Vdc	μAdc	nsec
Minimum	—	80	—	—
Maximum	100		100	6.0

Forward Voltage vs. Forward Current



Reverse Voltage vs. Reverse Current





Order of procedure diagram for non-TX and "TX" types.

RECTIFIERS

Military Approved, 1 Amp, Fast Recovery

JAN, JANTX, & JANTXV 1N4942
JAN, JANTX, & JANTXV 1N4944
JAN, JANTX, & JANTXV 1N4946

FEATURES

- Qualified to MIL-S-19500/359
- Surge Rating: 15A
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION

These fast recovery rectifiers are suitable for use as power devices for many applications. Devices are available as JAN, JANTX or JANTXV.

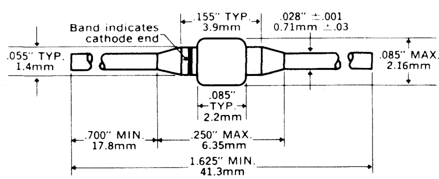
ABSOLUTE MAXIMUM RATINGS

Maximum Reverse Voltage	Type
200V	JAN, JANTX, & JANTXV 1N4942
400V	JAN, JANTX, & JANTXV 1N4944
600V	JAN, JANTX, & JANTXV 1N4946

Maximum Average D.C. Output Current
@ $T_A = 55°C$ 1.0A
@ $T_A = 100°C$ 0.75A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 15A
Operating Temperature Range .... —65°C to +175°C
Storage Temperature Range .... —65°C to +175°C
Thermal Resistance .... See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 1N4942, 1N4944, 1N4946



BODY A

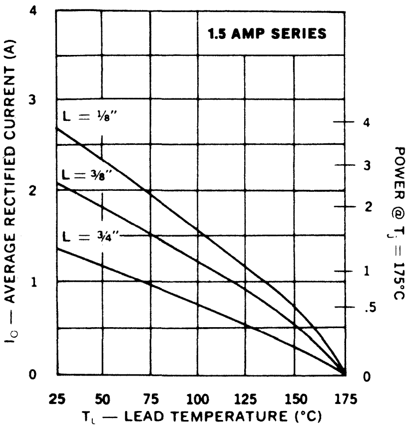
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

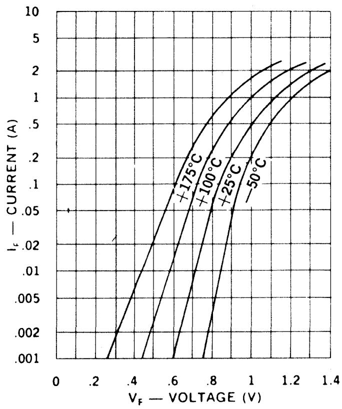
Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*	Capacitance @ V_R = 12V f = 1MHz
			Min.	Max.	25°C	150°C		
J, JTX, JTXV 1N4942	200V	220V	0.6V	1.3Vdc	1.0μA	200μA	150ns	45pf
J, JTX, JTXV 1N4944	400V	440V	@ 1 Adc				150ns	35pf
J, JTX, JTXV 1N4946	600V	660V					250ns	25pf

*Measured in circuit I_F = ½A, I_R = 1.0A, I_{REC} = ¼A

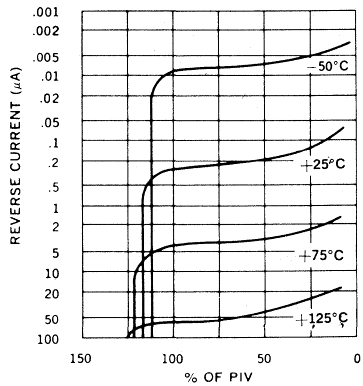
Maximum Current vs Lead Temperature



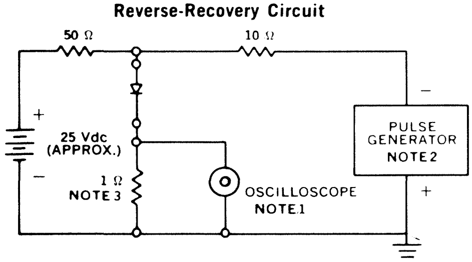
Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



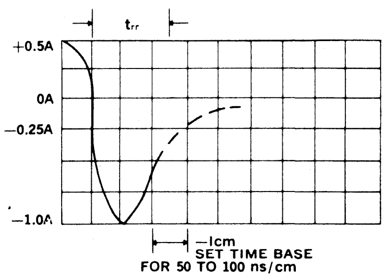
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform.



POWER ZENERS
5 Watt, Military

1N4954-1N4995
JAN, JANTX & JANTXV
1N4996

FEATURES
- 2 Times Greater Surge Rating than Conventional 10 Watt Zeners
- Small Physical Size

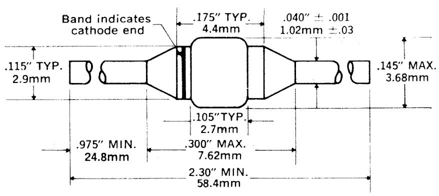
DESCRIPTION
Fused-in-glass, metallurgically-bonded 5 watt zeners, qualified to MIL-S-19500/356.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 390V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +175°C

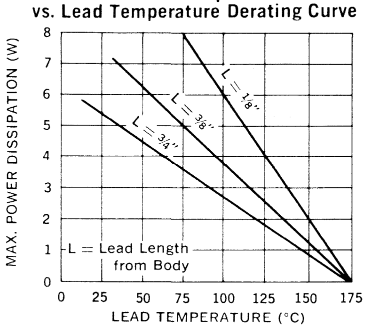
MECHANICAL SPECIFICATIONS

1N4954-1N4955 JAN, JANTX & JANTXV ,1N4996

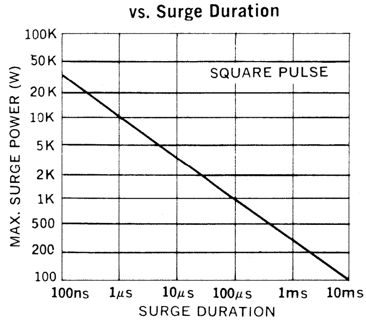


BODY B

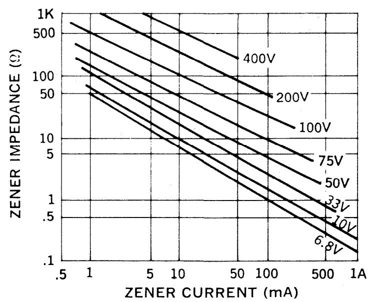
Power Dissipation vs. Lead Temperature Derating Curve



Max. Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

	Electrical Specifications at 25°C									Maximum Ratings	
Type	Nominal Zener Voltage† V_Z @ I_{ZT}	Test Current I_{ZT}	Maximum Zener Impedance § Z_Z @ I_{ZT}	Z_{ZK}†† @ I_{ZK} = 1mA	Voltage Regulation ΔBV §§	Maximum Reverse Leakage Current I_R††	I_R	V_R	Maximum Temperature Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current‡ I_S
±5% Tolerance	Volts	mA	Ohms	Ohms	Volts	μA		Volts	%/°C	mA	Amps
1N4954*	6.8	175	1.0	1000	0.7	150	300	5.2	.05	700	40
1N4955*	7.5	175	1.5	800	0.7	100	200	5.7	.06	630	32
1N4956*	8.2	150	1.5	600	0.7	50	100	6.2	.06	580	24
1N4957*	9.1	150	2.0	400	0.7	25	50	6.9	.06	520	22
1N4958*	10.0	125	2.0	125	0.8	25	25	7.6	.07	475	20
1N4959*	11	125	2.5	130	0.8	10	15	8.4	.07	430	19
1N4960*	12	100	2.5	140	0.8	10	10	9.1	.07	395	18
1N4961*	13	100	3.0	145	0.8	10	10	9.9	.08	365	16
1N4962*	15	75	3.5	150	1.0	5	5	11.4	.08	315	12
1N4963*	16	75	3.5	155	1.1	5	5	12.2	.08	294	10
1N4964*	18	65	4.0	160	1.2	5	5	13.7	.085	264	9.0
1N4965*	20	65	4.5	165	1.5	2	2	15.2	.085	237	8.0
1N4966*	22	50	5.0	170	1.8	2	2	16.7	.085	216	7.0
1N4967*	24	50	5.0	175	2.0	2	2	18.2	.090	198	6.5
1N4968*	27	50	6.0	180	2.0	2	2	20.6	.090	176	6.0
1N4969*	30	40	8	190	2.5	2	2	22.8	.090	158	5.5
1N4970*	33	40	10	200	2.8	2	2	25.1	.095	144	5.0
1N4971*	36	30	11	220	3.0	2	2	27.4	.095	132	4.5
1N4972*	39	30	14	230	3.0	2	2	29.7	.095	122	4.0
1N4973*	43	30	20	240	3.3	2	2	32.7	.095	110	3.5
1N4974*	47	25	25	250	3.5	2	2	35.8	.095	100	3.2
1N4975*	51	25	27	270	4.0	2	2	38.8	.095	92	3.0
1N4976*	56	20	35	320	4.4	2	2	42.6	.095	84	2.8
1N4977*	62	20	42	400	5.0	2	2	47.1	.100	76	2.5
1N4978*	68	20	50	500	5.5	2	2	51.7	.100	70	2.2
1N4979*	75	20	55	620	6.0	2	2	56.0	.100	63.0	2.0
1N4980*	82	15	80	720	6.6	2	2	62.2	.100	58.0	1.8
1N4981*	91	15	90	760	7.5	2	2	69.2	.100	52.5	1.6
1N4982*	100	12	110	800	8.0	2	2	76.0	.100	47.5	1.4
1N4983*	110	12	125	1000	9.0	2	2	83.6	.100	43.0	1.2
1N4984*	120	10	170	1150	10	2	2	91.2	.100	39.5	1.00
1N4985*	130	10	190	1250	11	2	2	98.8	.105	36.6	0.80
1N4986*	150	8	330	1500	13	2	2	114.0	.105	31.6	0.75
1N4987*	160	8	350	1650	14	2	2	121.6	.105	29.4	0.70
1N4988*	180	5	450	1750	16	2	2	136.8	.110	26.4	0.60
1N4989*	200	5	500	1850	18	2	2	152	.110	23.6	0.50
1N4990*	220	5	550	2000	19	2	2	167	.115	21.6	0.50
1N4991*	240	5	650	2050	22	2	2	182	.115	19.8	0.40
1N4992*	270	5	800	2100	25	2	2	206	.120	17.5	0.35
1N4993*	300	4	950	2150	28	2	2	228	.120	15.6	0.30
1N4994*	330	4	1175	2200	32	2	2	251	.120	14.4	0.25
1N4995*	360	3	1400	2300	35	2	2	274	.120	13.0	0.22
1N4996	390	3	1800	2500	40	2	2	297	.120	12.0	0.20

* Available as JAN, JANTX & JANTXV.
† All zener voltages are measured with an automated test set using a 35 msec test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.
§ Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.
§§ ΔBV is obtained by measuring the voltage change when the test current is changed from 10% to 50% of Iz max under DC conditions. During this measurement the leads are heat sunk .375 inch from the body and maintained at 25°C.
★ Maximum current based on 5 Watt Rating. See lead temperature derating curves for proper mounting methods.
‡ Figures shown are for peak sinusoidal surge current of 8.3 msec duration, non-repetitive. The 8.3 ms square pulse rating is 71% of the value shown.
†† These specifications apply only to JAN and JANTX

RECTIFIERS
Military Approved, 3 Amp, Fast Recovery

1N5186-1N5190
JAN & JANTX

FEATURES
- Continuous Rating: 3A
- Qualified to MIL-S-19500/424
- PIV : to 600V
- Recovery Time: 150ns
- Miniature Size
- Controlled Avalanche

DESCRIPTION
These miniature fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz sine wave.
They are qualified to military specification and available as JAN, JANTX or JANTXV.

ABSOLUTE MAXIMUM RATINGS

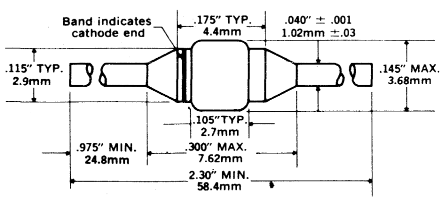
Peak Inverse Voltage	Type
100V	JAN & JANTX 1N5186
200V	JAN & JANTX 1N5187
400V	JAN & JANTX 1N5188
600V	JAN & JANTX 1N5190

Maximum Average D.C. Output Current

@ $T_A = 25°C$	3.0A
@ $T_A = 150°C$	0.7A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	80A
Operating Temperature Range	—65°C to +175°C
Storage Temperature Range	—65°C to +200°C
Thermal Resistance	See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

JAN & JANTX 1N5186-1N5190



BODY B

UNITRODE

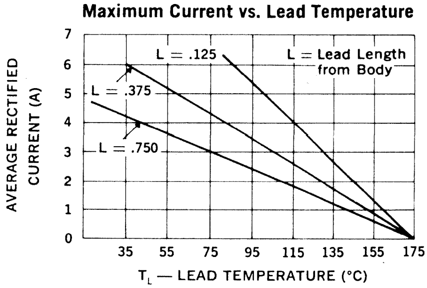
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 100μA	Peak Forward Voltage Min.	Peak Forward Voltage Max.	Maximum Reverse D.C. Current @ PIV 25°C	Maximum Reverse D.C. Current @ PIV 100°C
J, JTX 1N5186	100V	120V	0.9V	1.5V	2μA	100μA
J, JTX 1N5187	200V	240V	@ 9A(pk)			
J, JTX 1N5188	400V	480V	(8.3ms)			
J, JTX 1N5190	600V	660V				

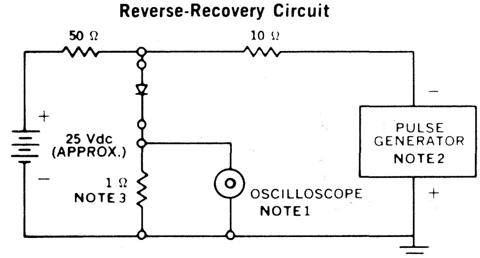
Type	Reverse Recovery Time*	Capacitance @ $V_R = 0V$ f = 1MHz	Capacitance @ $V_R = 4V$ f = 1MHz
J, JTX 1N5186	150ns	300pf	200pf
J, JTX 1N5187	200ns	300pf	170pf
J, JTX 1N5188	250ns	230pf	120pf
J, JTX 1N5190	400ns	180pf	90pf

*Recovery time measured from $I_F = 0.5A$ to $I_R = 1.0A$, $I_{REC} = 0.25A$

Maximum Current vs. Lead Temperature

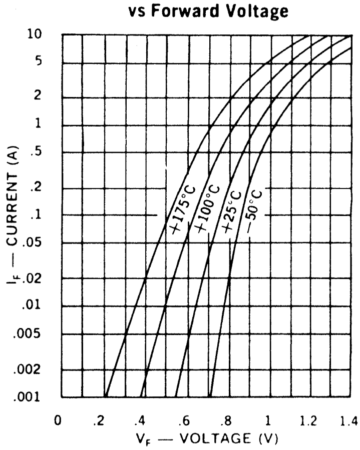


Reverse-Recovery Circuit

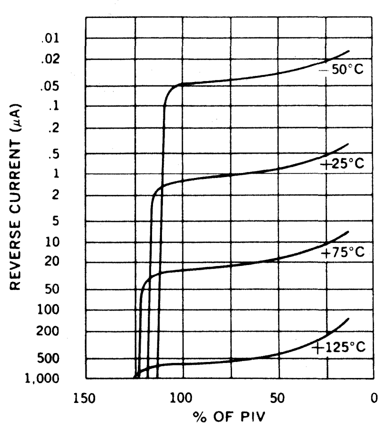


NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



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RECTIFIERS
Military Approved, Fast Recovery, 3 Amp

1N5415-1N5420
JAN, JANTX & JANTXV

FEATURES
- Qualified to MIL-S-19500/411
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION
This series of devices as designed to meet the need for high speed, power rectifiers in military high-rel power supplies.

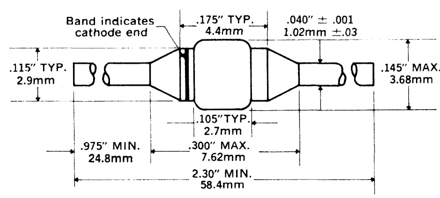
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	JAN, JANTX, JANTXV 1N5415
100V	JAN, JANTX, JANTXV 1N5416
200V	JAN, JANTX, JANTXV 1N5417
400V	JAN, JANTX, JANTXV 1N5418
500V	JAN, JANTX, JANTXV 1N5419
600V	JAN, JANTX, JANTXV 1N5420

Maximum Average D.C. Output Current
@ $T_A = 55°C$ 3.0A
@ $T_A = 100°C$ 2.0A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 80A
Operating Temperature Range .... —65°C to +175°C
Storage Temperature Range .... —65°C to +200°C
Thermal Resistance Θ_{JL} @ L = 3/8" .... 20°C/W
See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N5415-1N5420



Dimensions in inches.

BODY B

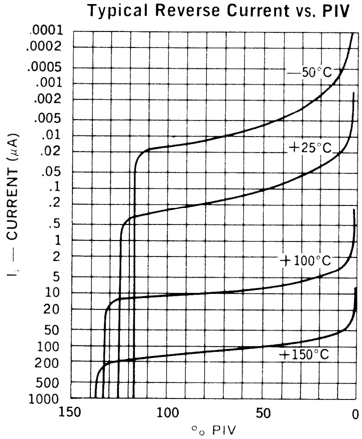
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

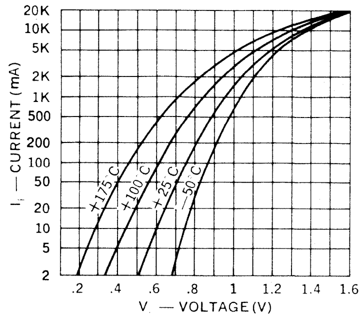
Type	PIV	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
			Min.	Max.	25°C	100°C	
J, JTX, JTXV 1N5415	50V	55V	0.6V	1.5V(pk) @ 9Adc tp = 300μs	1.0μA	20μA	150
J, JTX, JTXV 1N5416	100V	110V					150
J, JTX, JTXV 1N5417	200V	220V					150
J, JTX, JTXV 1N5418	400V	440V					150
J, JTX, JTXV 1N5419	500V	550V					250
J, JTX, JTXV 1N5420	600V	660V					400

*Measured in circuit I_F = .05 A, I_R = 1A, I_{REC} = 0.25 A.

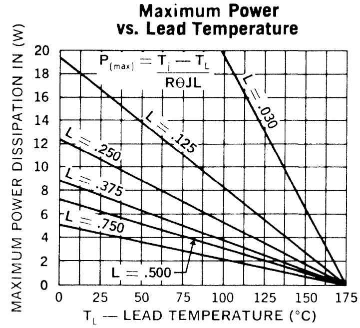
Typical Reverse Current vs. PIV



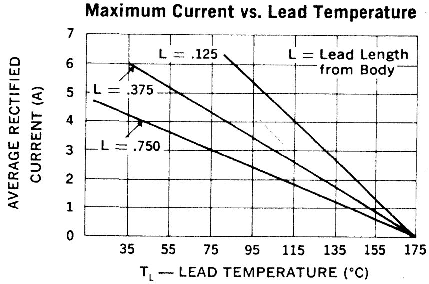
Typical Forward Current vs. Forward Voltage



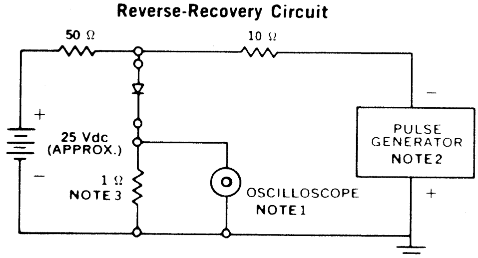
Maximum Power vs. Lead Temperature



Maximum Current vs. Lead Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS

Military Approved, 5 Amp, General Purpose

1N5550-1N5553
JAN, JANTX & JANTXV

FEATURES

- Qualified to MIL-S-19500/420A
- Continuous Rating: 5A
- PIV: to 800V
- TX Parts 100% Screened
- Miniature Size
- Controlled Avalanche

DESCRIPTION

This series of military approved rectifiers is useful in many military applications. The 100% screening requirements in the "TX" version combined with the unique Unitrode construction assures the highest degree of reliability.

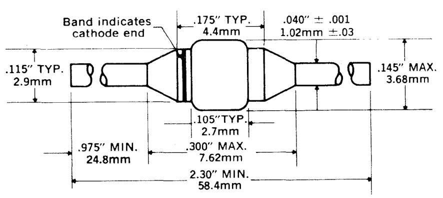
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN, JANTX & JANTXV 1N5550
400V	JAN, JANTX & JANTXV 1N5551
600V	JAN, JANTX & JANTXV 1N5552
800V	JAN, JANTX & JANTXV 1N5553

Maximum Average D.C. Output Current
@ $T_A = 55°C$ 3.0A
@ $T_L = 55°C$ 5.0A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 100A
Operating Temperature Range .... —65°C to +175°C
Storage Temperature Range .... —65°C to +200°C
Thermal Resistance .... See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N5550-1N5553



BODY B

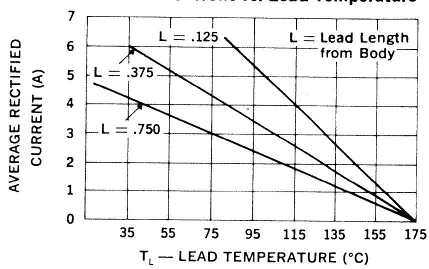
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

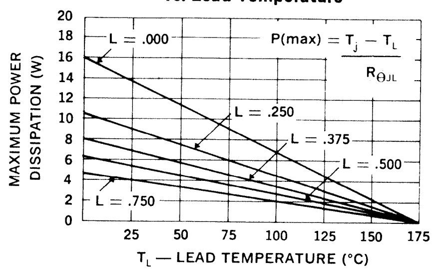
Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 50μA	Peak Forward Voltage Min.	Peak Forward Voltage Max.	Maximum Leakage Current @ PIV 25°C	Maximum Leakage Current @ PIV 100°C	Maximum Reverse Recovery Time*
J, JTX, JTXV 1N5550	200V	240V	0.6V @ $I_F = 9A(pk)$ (8.3ms)	1.2V	1.0μA	75μA	2.0μs
J, JTX, JTXV 1N5551	400V	460V					
J, JTX, JTXV 1N5552	600V	660V					
J, JTX, JTXV 1N5553	800V	880V					

*Measured in a test circuit I_F =0.5A, I_R = 1.0A, I_{REC} = 0.25A

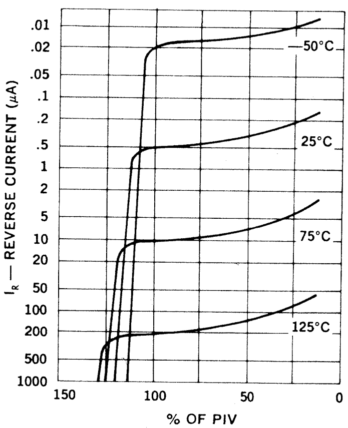
Maximum Current vs. Lead Temperature



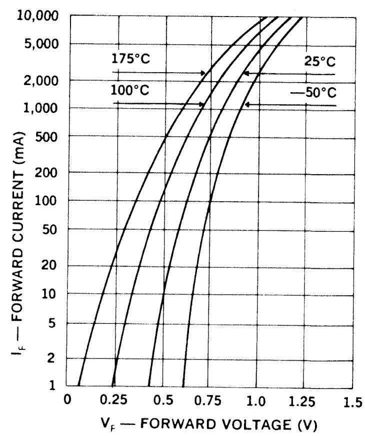
Maximum Power Dissipation vs. Lead Temperature



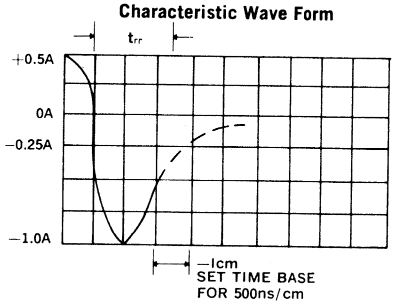
Reverse Current vs. PIV



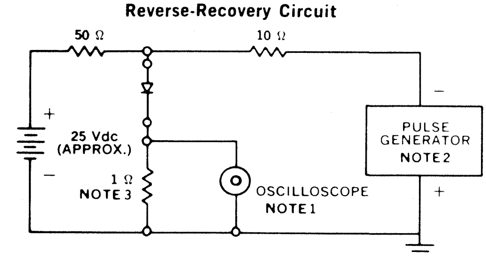
Forward Current vs. Forward Voltage



Characteristic Wave Form



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

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POWER ZENERS
Transient Suppressor Diodes

JAN & JANTX 1N5555-1N5558
JAN & JANTX 1N5610-1N5613

FEATURES
- 1500 Watts for 1ms Pulse Power Capability
- Small Physical Size
- Designed to be Used in Mil-Std-704A Applications

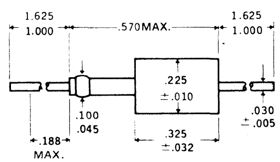
DESCRIPTION
Zener diodes with high surge capability qualified to MIL-S-19500/434. 1N5555 series in DO-13 package and 1N5610 series on double C body for ultimate reliability in repetitive surge applications.

ABSOLUTE MAXIMUM RATINGS (at 25°C except where otherwise noted)

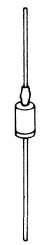
	1N5555 1N5610	1N5556 1N5611	1N5557 1N5612	1N5558 1N5613
Zener Voltage	See Electrical Specifications			
Forward Surge Current	200A	200A	200A	200A
Zener Surge Current, at 25°C	32.0A	24.0A	19.0A	5.7A
Surge Current, at 150°C	5.5A	4.8A	3.2A	1.0A
Surge Power	See Graph			
Storage and Operating Temperature	—65°C to +175°C			

MECHANICAL SPECIFICATIONS

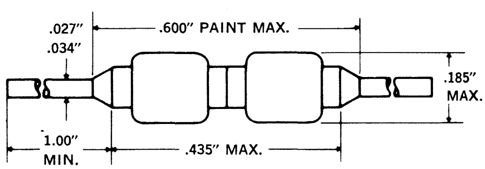
JAN & JANTX 1N5555-1N5558



DO-13



JAN & JANTX 1N5610-1N5613



Polarity: Cathode indicated by band.
Weight: 1.5 gram (approximate).
Mounting Position: Any. **Leads:** Tinned Copper.
Marking: Type number marked on unit.

Double C BODY

UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Min. Zener Voltage § Vz @ ImA	Max. Zener Voltage† Vz @ Is		Max. Reverse Leakage Current I_R @ V_R		Max. Forward Voltage‡ @ 100 Amps	Typical Temperature Coefficient
	Volts	Volts	Amps	μA	Volts	Volts	%/°C
1N5555* & 1N5610*	33.0	47.5	32.0	5.0	30.5	4.8	.093
1N5556* & 1N5611*	43.7	63.5	24.0	5.0	40.3	4.8	.094
1N5557* & 1N5612*	54.0	79.5	19.0	5.0	49.0	4.8	.096
1N5558* & 1N5613*	191.0	265.0	5.7	5.0	175.0	4.8	.100

Notes: * Available as JAN and JANTX.
§ Duration of applied current ≤ 300ms, duty cycle ≤ 2%.
† Utilizing a pulse which decays exponentially to 50% of the peak value in 1ms. See graph entitled "Pulse Waveform."
‡ Peak Sinusoidal surge current of 8.3ms duration, non-repetitive.

APPLICATIONS

Voltage transients can be suppressed with series elements, shunt elements, or a combination of both. These elements may be passive or active. For low and medium power applications, a series resistor and zener clamp offer several attractive features:

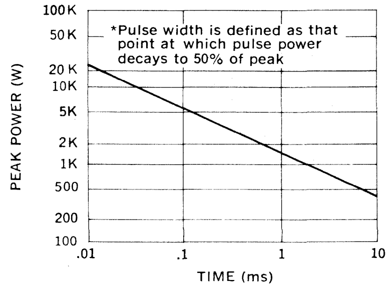
1. Simplicity of design
2. High reliability
3. Fast response time

The 1N5610 series of surge suppressors will suppress the following transients defined by *MIL-S-704A* without the use of any series limiting resistance beyond that provided by the source:

1. All 600V transients (category #1 on chart below)
2. All 80V transients except those generated by the main voltage regulator (category #2 on chart below)
3. The overvoltage transients generated by the *main voltage regulator* (category #3 on chart below) will also be suppressed by the 1N5610 series if:
   a. A 20 ohm series limiting resistor is used, or
   b. No series resistance is used but the zener is protected within 500 μs by using, for example, an SCR crowbar

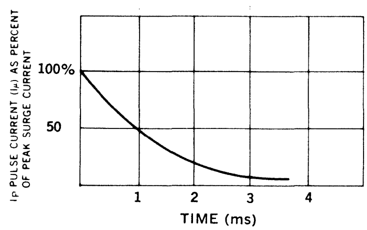
The above statements are based on the source impedances and dv/dt characteristics as given in ARINC* Specification #413. This report entitled "Guidance for Aircraft Electrical Power Utilization and Transient Protection" serves to further define *MIL-STD-704A* for large aircraft electrical systems.

Peak Power Rating vs. Pulse Width*



Category	Source of Transient	Maximum Amplitude	Duration	Min. Source Impedance	dv/dt
1.	Inductive Switching	600 V	≤ 10 μs	50 ohms	
2.	BUS Switching	80 V	≤ 10 ms	15 ohms	
3.	Main Voltage Regulator	80 V	≥ 10 ms	0.2 ohms	50V/ms

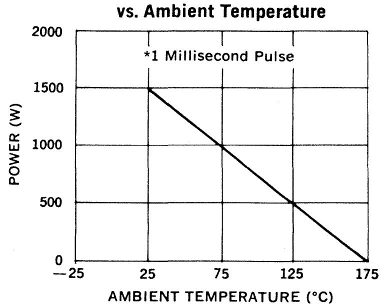
Pulse Waveform



These Surge Suppressors are useful in a variety of other applications where semiconductor devices must function reliably in an environment subject to extremely high but short term surges.

* ARINC stands for Aeronautical Radio, Inc. (Annapolis, Maryland 21401)

Peak Power Rating* vs. Ambient Temperature



RECTIFIER ASSEMBLIES

High Voltage Stacks, 1 Amp to 5 Amp, Military Approved

JAN 1N5597
JAN 1N5600
JAN 1N5603

FEATURES

- Qualified to MIL-S-19500/404A
- PIV: to 10kV
- Surge Ratings: to 200A
- Current Ratings: to 5A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Modular Package For Easy Stacking

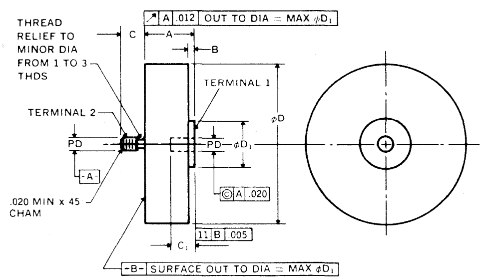
DESCRIPTION

This series of military high-voltage high-current stacks offers the utmost in reliability as required in military system designs. The rectifiers are assembled with diodes which have been subjected to TX type screening tests.

ABSOLUTE MAXIMUM RATINGS

	JAN 1N5597	JAN 1N5600	JAN 1N5603
Peak Inverse Voltage	10kV	5kV	5kV
Maximum Average D.C. Output Current @ $T_C = 75°C$	1A	2A	5A
Non-Repetitive Sinusoidal Surge (8.3ms) @ $T_C = 75°C$	30A	80A	200A
Operating and Storage Temperature Range	−65°C to +150°C		

MECHANICAL SPECIFICATIONS



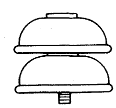
JAN 1N5597 JAN 1N5600

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses — Minimum	Maximum	NOTES
A	.73 (18.54)	.83 (21.08)	8
B		.080 (2.03)	
C	.240 (6.10)	.264 (6.71)	2, 6
C_1	.265 (6.73)	.400 (10.16)	4
ϕD	1.85 (46.99)	1.95 (49.53)	
ϕD_1	.57 (14.48)	.67 (17.02)	

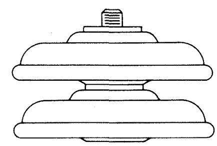
JAN 1N5603

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses — Minimum	Maximum	NOTES
A	.970 (24.64)	1.020 (25.91)	8
B	.050 (1.27)	.080 (2.03)	
C	.307 (7.80)	.317 (8.05)	3
C_1	.318 (8.08)	.400 (10.16)	5, 7
ϕD	3.450 (87.63)	3.650 (92.71)	
ϕD_1	.95 (24.13)	1.250 (31.75)	

JAN 1N5597, JAN 1N5600



JAN 1N5603



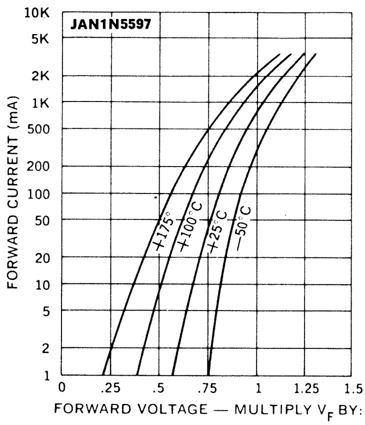
1. All marking shall be on cathode side of module.
2. Threaded stud ¼-28UNF-2A.
3. Threaded stud ⅜-24UNF-2A.
4. Threaded insert ¼-28UNF-2B.
5. Threaded insert ⅜-24UNF-2B.
6. Cathode connected to terminal 2.
7. Cathode connected to terminal 1.
8. Module contour within dimension A is not specified.

UNITRODE

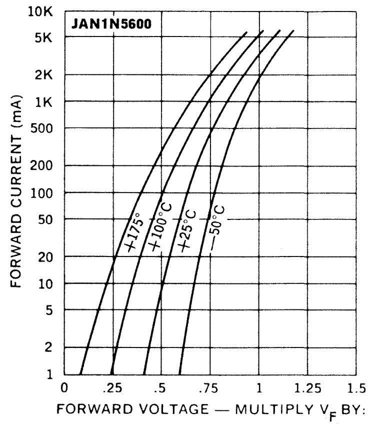
Electrical Specifications (at 25°C unless noted)

Type	PIV	Forward Voltage Drop		Maximum Leakage Current @ PIV		Capacitance @ V_R = 100V		Maximum Reverse Transient Energy Absorption
		Min.	Max.	T_A = 25°C	T_A = 100°C	Min.	Max.	
	kV			μA	μA	pf	pf	joules
JAN 1N5597	10	13V @ 1A	19V @ 1A	1	75	5	30	2
JAN 1N5600	5	6V @ 2A	10V @ 2A	5	100	7	30	6
JAN 1N5603	5	6V @ 5A	10V @ 5A	5	100	15	40	12

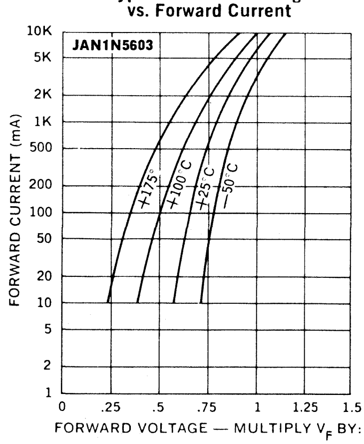
Typical Forward Voltage vs. Forward Current



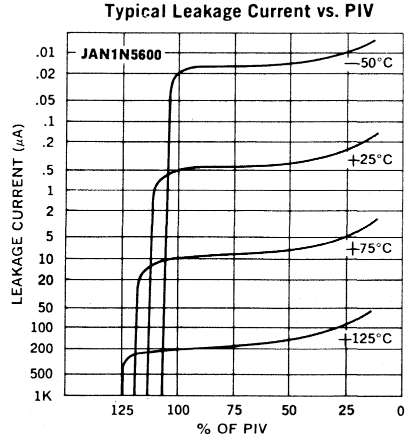
Typical Forward Voltage vs. Forward Current



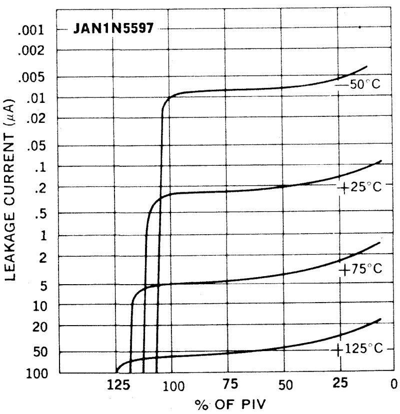
Typical Forward Voltage vs. Forward Current



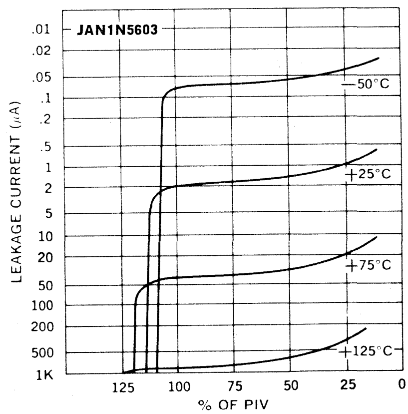
Typical Leakage Current vs. PIV



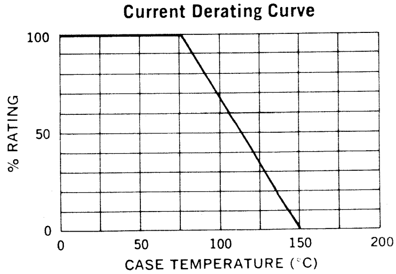
Typical Leakage Current vs. PIV

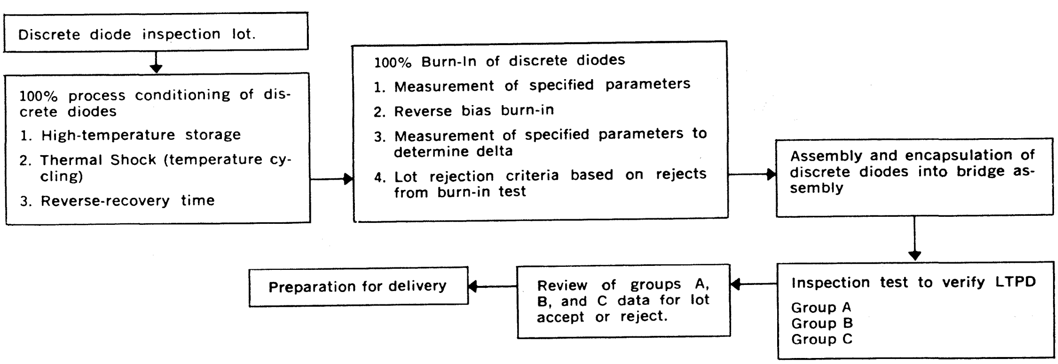


Typical Leakage Current vs. PIV



Current Derating Curve





RECTIFIERS
Standard Recovery, 1 Amp Military Approved

1N5614, 1N5616, 1N5618, 1N5620, JAN, JANTX & JANTXV

FEATURES
- Qualified to MIL-S-19500/427
- PIV: to 1000V
- Controlled Avalanche

DESCRIPTION
This series of medium power general purpose rectifiers can be used in the most demanding military supplies. Rugged mechanical integrity and tight electrical parameters make them particularly useful.

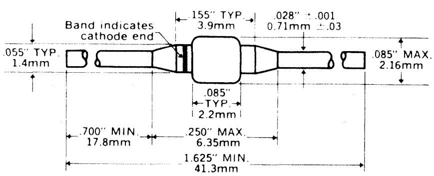
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN, JANTX & JANTXV 1N5614
400V	JAN, JANTX & JANTXV 1N5616
600V	JAN, JANTX & JANTXV 1N5618
800V	JAN, JANTX & JANTXV 1N5620

Maximum Average D.C. Output Current
@ $T_A = 55°C$ 1.0A
@ $T_A = 100°C$ 0.75A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 30A
Operating Temperature Range .... −65°C to +175°C
Storage Temperature Range .... −65°C to +200°C
Thermal Resistance θ_{JL} @ L = 3/8" .... 38°C/W
See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N5614, 1N5616, 1N5618, 1N5620



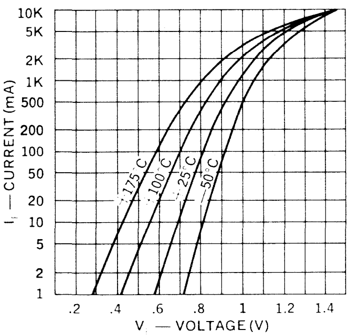
BODY A

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

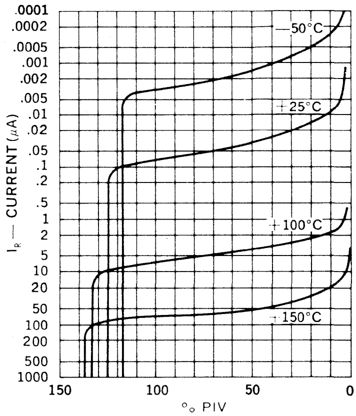
Type	PIV	Minimum Reverse Breakdown Voltage @ 50µA	Forward Voltage Min.	Forward Voltage Max.	Maximum Reverse Current 25°C	Maximum Reverse Current 100°C	Maximum Reverse Recovery Time*
J, JTX, JTXV 1N5614	200V	220V	0.8	1.3V(pk) @ 3.0A tp = 300µs	0.5µA	25µA	2.0µs
J, JTX, JTXV 1N5616	400V	440V					
J, JTX, JTXV 1N5618	600V	660V					
J, JTX, JTXV 1N5620	800V	880V					

*Measured in Circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

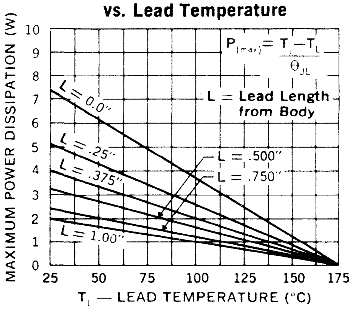
Forward Voltage vs. Forward Current



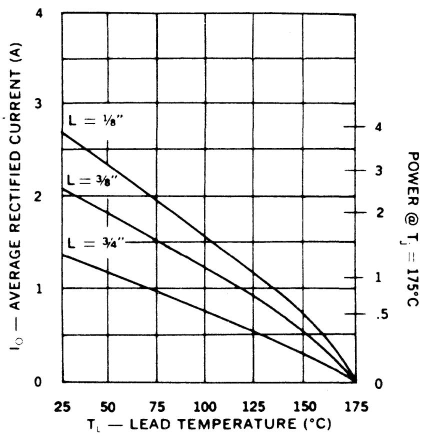
Typical Reverse Current vs. PIV



Maximum Power Dissipation vs. Lead Temperature



Maximum Current vs Lead Temperature



RECTIFIERS

Military Approved, Fast Recovery, 1 Amp

1N5615, 1N5617, 1N5619
JAN, JANTX & JANTXV

FEATURES

- Qualified to MIL-S-19500/429
- PIV: to 600V
- Controlled Avalanche

DESCRIPTION

This series of military approved rectifiers is useful in many military applications where fast recovery and medium power are required. The 100% screening requirements in the "TX" version combined with the unique Unitrode construction assures the highest degree of reliability.

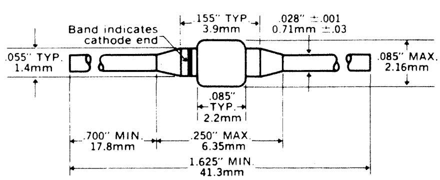
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
200V	JAN, JANTX, JANTXV 1N5615
400V	JAN, JANTX, JANTXV 1N5617
600V	JAN, JANTX, JANTXV 1N5619

Maximum Average D.C. Output Current
@ $T_A = 55°C$ 1.0A
@ $T_A = 100°C$ 0.75A
Non-Repetitive Sinusoidal
Surge Current (8.3ms) 25A
Operating Temperature Range .... −65°C to +175°C
Storage Temperature Range .... −65°C to +200°C
Thermal Resistance θ_{JL} .... 38°C/W
See Lead Temperature Derating Curve

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N5615, 1N5617, 1N5619



BODY A

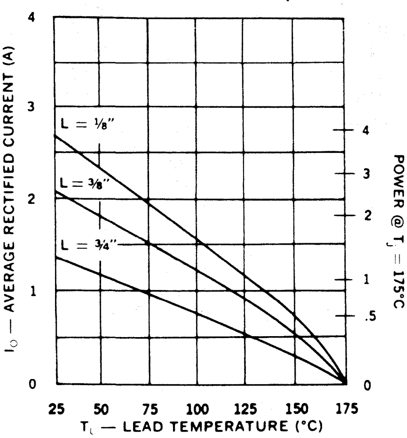
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

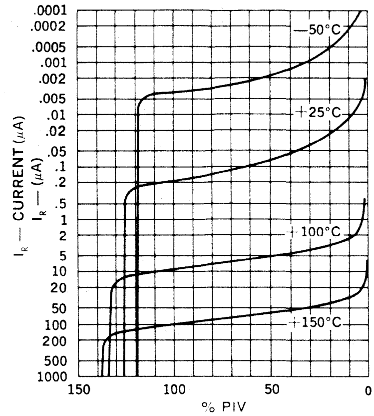
Type	PIV	Minimum Reverse Breakdown Voltage @ 50μA	Forward Voltage Min.	Forward Voltage Max.	Maximum Reverse Current 25°C	Maximum Reverse Current 100°C	Maximum Reverse Recovery Time*	Capacitance @ $V_R = 12V$ f = 1MHz
J, JTX, JTXV 1N5615	200V	220V	0.8V	1.6V(pk) @ 3.0 Adc tp = 300μs	0.5μA	25μA	150ns	45pf
J, JTX, JTXV 1N5617	400V	440V					150ns	35pf
J, JTX, JTXV 1N5619	600V	660V					250ns	25pf

*Measured in Circuit $I_F = ½A$, $I_R = 1A$, $I_{REC} = ¼A$

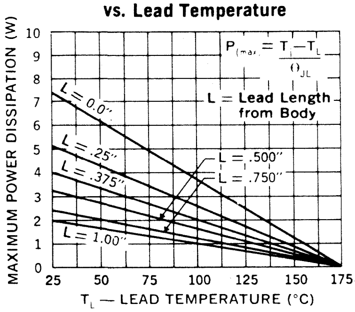
Maximum Current vs Lead Temperature



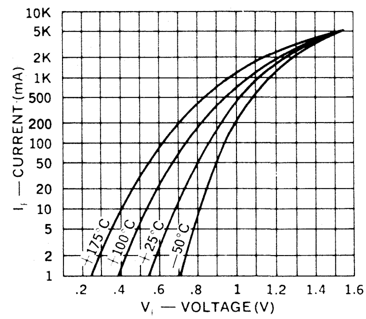
Typical Reverse Current vs. PIV



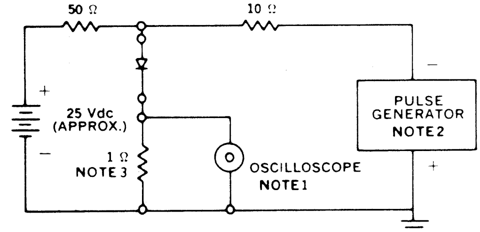
Maximum Power vs. Lead Temperature



Forward Voltage vs. Forward Current



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS

High Efficiency, ESP, 2.5 Amp to 20 Amp

1N5802-1N5806
1N5807-1N5811
1N5812-1N5816

FEATURES

- Exceptional Efficiency
- Low Forward Voltage
- Extremely Fast Reverse Recovery Time
- Extremely Fast Forward Recovery Time
- High Surge
- Small Size
- Rugged, High Current Termination
- Radiation Tolerant

DESCRIPTION

This series of High Efficiency Power Rectifiers allows circuit designers to design high current, high frequency supplies to 500 kHz with very low diode losses. The high forward surge capability makes these devices useful in protective circuits.

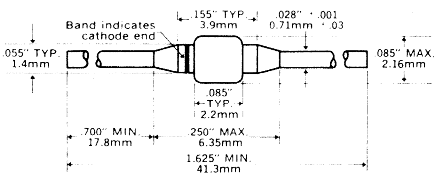
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5 Amp Series	6 Amp Series	20 Amp Series
50V	1N5802	1N5807	1N5812
75V	1N5803	1N5808	1N5813
100V	1N5804	1N5809	1N5814
125V	1N5805	1N5810	1N5815
150V	1N5806	1N5811	1N5816

	2.5 AMP SERIES	6.0 AMP SERIES	20 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_L = 75°C$, $L = 3/8''$	2.5A	6.0A	—
@ $T_C = 100°C$			20.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	35A	125A	250A
Operating and Storage Temperature Range	—65°C to +175°C		
Thermal Resistance 2.5A and 6A Series	See Lead Temperature Derating Curve		
20A Series			3.0°C/W

MECHANICAL SPECIFICATIONS

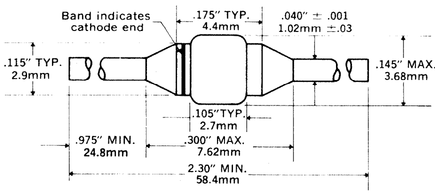
1N5802-1N5806



Typical Weight — 0.22 grams

BODY A

1N5807-1N5811

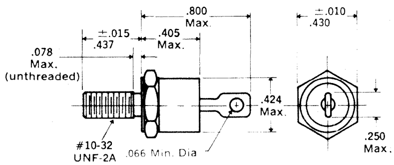


Typical Weight — 0.75 grams

BODY B

MECHANICAL SPECIFICATIONS

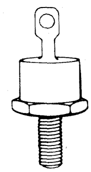
1N5812-1N5816



Part Identification: Type number printed on metal case.
Polarity: Cathode to stud end
Max. Weight: 7.0 Grams
Installation Precautions: Maximum unlubricated stud torque: 10 inch pounds
Thermal Resistance: 3.0°C/W

Dimensions in inches.

DO-4

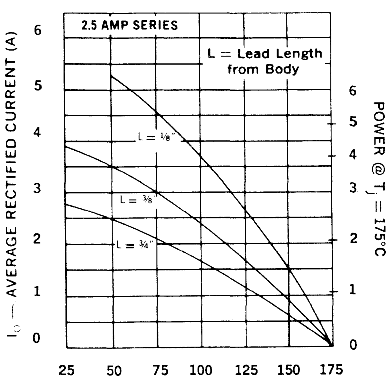


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop*	Leakage Current @ PIV		Maximum Reverse Recovery Time I_F, I_R, I_{REC}	Typical Forward Recovery Time @ 1A Recover to 1V	Typical Forward Recovery Voltage @ 1A tr = 8ns	Typical Junction Capacitance @ —10V
			25°C	100°C				
1N5802 1N5803 1N5804 1N5805 1N5806	50V 75V 100V 125V 150V	.875 @ 1A	1μA	50μA	25ns, 0.5A-0.5A-0.05A	15ns	1.5V	15pf
1N5807 1N5808 1N5809 1N5810 1N5811	50V 75V 100V 125V 150V	.875 @ 4A	5μA	150μA	30ns, 1.0-1.0-0.1A	15ns	1.5V	45pf
1N5812 1N5813 1N5814 1N5815 1N5816	50V 75V 100V 125V 150V	.900 @ 10A	10μA	750μA	35ns, 1.0-1.0-0.1A	15ns	1.5V	200pf

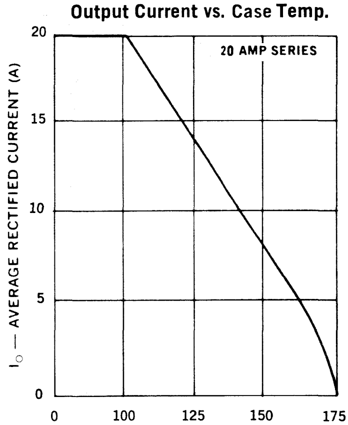
*Pulse width = 250ms

Output Current vs. Lead Temp.



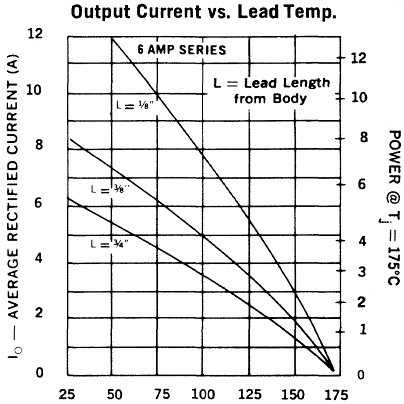
T_L — LEAD TEMPERATURE (°C)

Output Current vs. Case Temp.



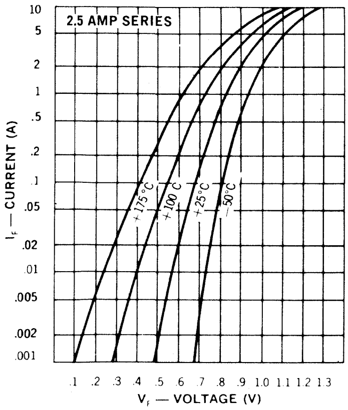
CASE TEMPERATURE (°C)

Output Current vs. Lead Temp.

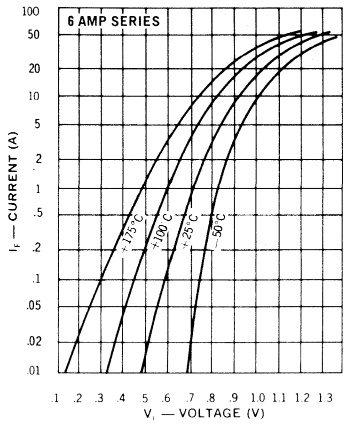


T_L — LEAD TEMPERATURE (°C)

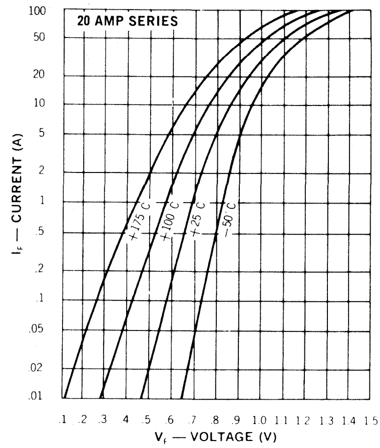
Typical Forward Current vs. Forward Voltage



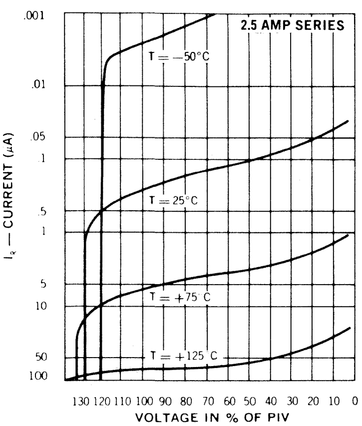
Typical Forward Current vs. Forward Voltage



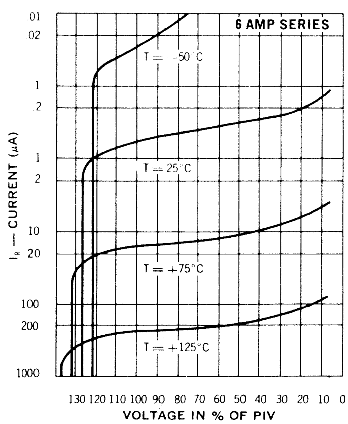
Typical Forward Current vs. Forward Voltage



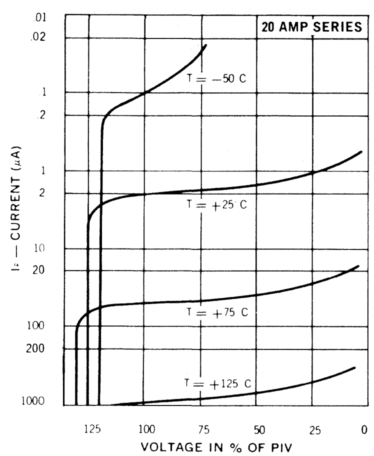
Typical Reverse Current vs. Voltage



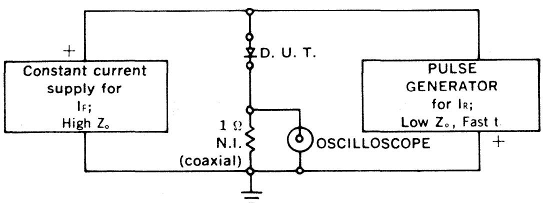
Typical Reverse Current vs. Voltage



Typical Reverse Current vs. Voltage

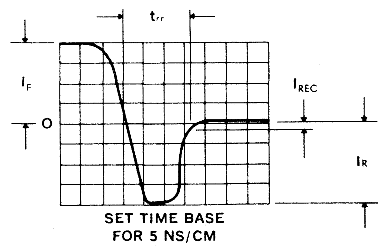


Reverse-Recovery Time Circuit

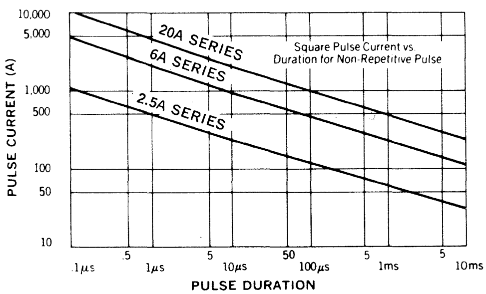


NOTES:
1. Oscilloscope: Rise time ⩽ 3 ns; input impedance = 50 Ω.
2. Pulse Generator: Rise time ⩽ 8 ns; source impedance 10 Ω.

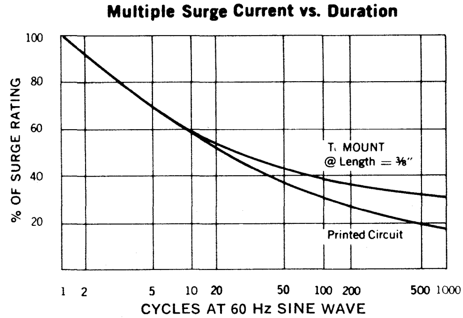
Characteristic Waveform



Forward Pulse Current vs. Duration



Multiple Surge Current vs. Duration



UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

RECTIFIERS

Military Approved, High Efficiency, 2.5 Amp and 6.0 Amp

1N5802, 1N5804, 1N5806, 1N5807, 1N5809, 1N5811 JAN, JANTX & JANTXV

FEATURES

- Qualified to MIL-S-19500/477
- PIV: to 150V
- Low Forward Voltage

DESCRIPTION

This series of high efficiency power rectifiers are particularly applicable to switching regulator power supplies where extremely fast switching and low forward losses are most important.

ABSOLUTE MAXIMUM RATINGS

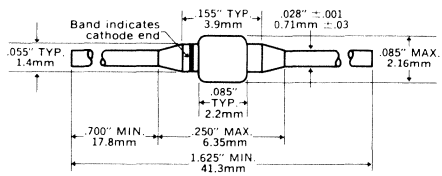
Peak Inverse Voltage	2.5A Series	6.A Series
50V	JAN, JANTX & JANTXV 1N5802	JAN, JANTX & JANTXV 1N5807
100V	JAN, JANTX & JANTXV 1N5804	JAN, JANTX & JANTXV 1N5809
150V	JAN, JANTX & JANTXV 1N5806	JAN, JANTX & JANTXV 1N5811

	2.5A SERIES	6A SERIES
Maximum Average D.C. Output Current		
@ $T_L = 75°C$, $L = 3/8''$	2.5A	6.0A
@ $T_A = 55°C$	1.0A	3.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	35A	125A
Operating Temperature Range	−65°C to +175°C	
Storage Temperature Range	−65°C to +200°C	
Thermal Resistance, θ_{JL} @ $L = 3/4''$	59°C/W	35.5°C/W

See lead temperature derating curve

MECHANICAL SPECIFICATIONS

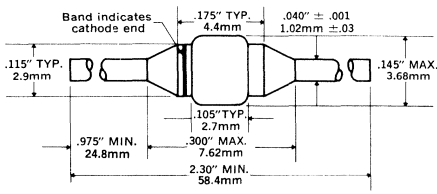
J, JTX, JTXV 1N5802-1N5806



Dimensions in inches.

BODY A

J, JTX, JTXV 1N5807-1N5811



Dimensions in inches.

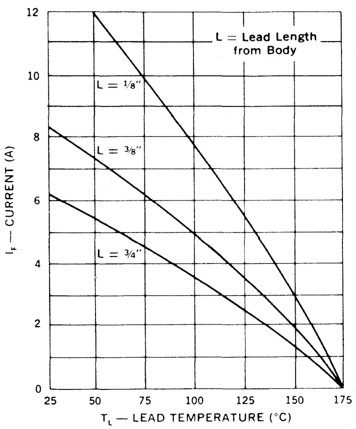
BODY B

UNITRODE

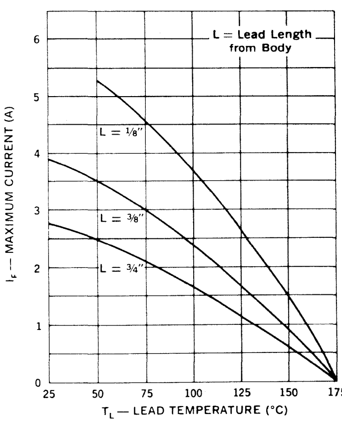
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

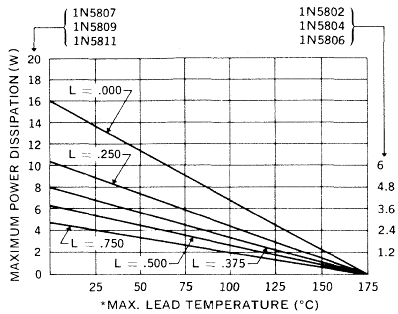
Type	PIV	Minimum Breakdown Voltage @ 100μA	Forward Voltage @ 25°C	Forward Voltage @ 100°C	Maximum Reverse Current @ PIV 25°C	Maximum Reverse Current @ PIV 100°C	Maximum Reverse Recovery Time
J, JTX, JTXV 1N5807	50V	60V	.875V Max. @ 4A (pk) .925V Max. @ 6A (pk)	.8V Max. @ 4A (pk)	5μA	150μA	30ns $I_F = I_R = 1.0A$ $I_{REC} = 0.1A$ di/dt = 100A/μs min.
J, JTX, JTXV 1N5809	100V	110V					
J, JTX, JTXV 1N5811	150V	160V					
J, JTX, JTXV 1N5802	50V	60V	.875V Max. @ 1A (pk) .975V Max. @ 2.5A (pk)	.8V Max. @ 1A (pk)	1μA	50μA	25ns $I_F = I_R = 0.5A$ $I_{REC} = 0.05A$ di/dt = 65A/μs min.
J, JTX, JTXV 1N5804	100V	110V					
J, JTX, JTXV 1N5806	150V	160V					

Output Current vs. Lead Temperature 1N5807-5811



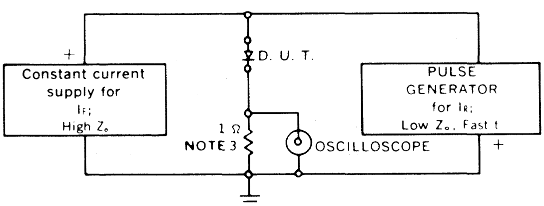
Output Current vs. Lead Temperature 1N5802-5806





*Maximum lead temperature in °C (T_L) at point "L" from body. (For maximum operating junction temperature of 175°C with equal two-lead conditions.)

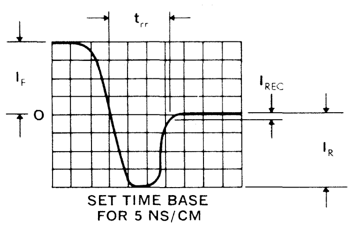
Reverse-Recovery Circuit



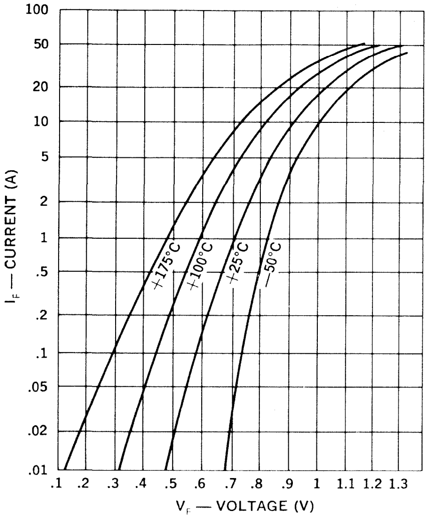
NOTES:

1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

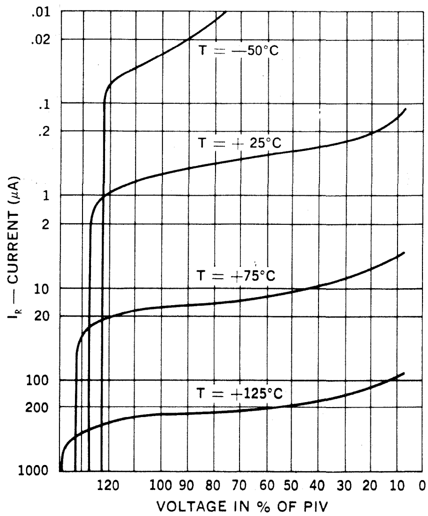
Characteristic Waveform



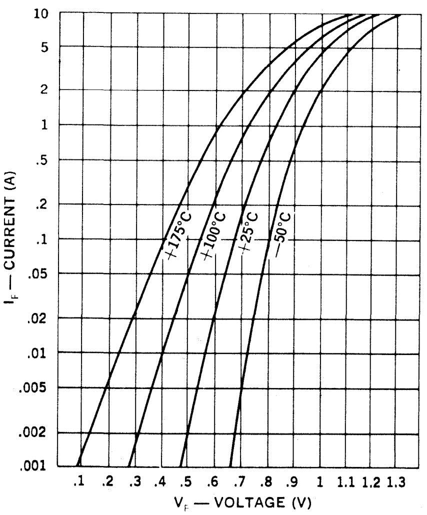
Typical Forward Current vs. Forward Voltage
JAN & JANTX 1N5807-5811



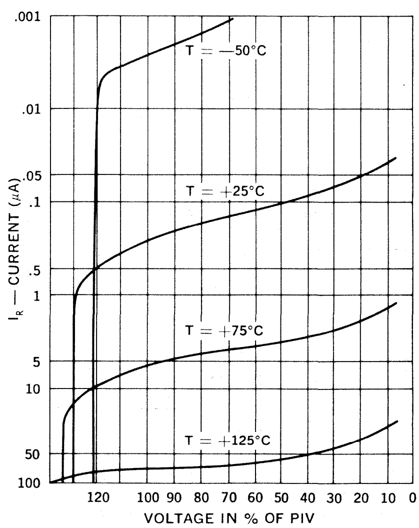
Typical Reverse Current vs. Voltage
JAN & JANTX 1N5807-5811



Typical Forward Current vs. Forward Voltage
JAN & JANTX 1N5802-5806



Typical Reverse Current vs. Voltage
JAN & JANTX 1N5802-5806



RECTIFIERS
Military Approved
High Efficiency, 20 Amp

1N5812, 1N5814, 1N5816
JAN, JANTX & JANTXV

FEATURES
- Qualified to MIL-S-19500/478
- Exceptional Efficiency
- Mechanically Rugged
- Low Thermal Resistance
- JAN, JANTX and JANTXV Available

DESCRIPTION
This series is suited for use as a power rectifier in switching regulator and high frequency inverter/converter and other appropriate equipment circuits where low voltage drop and fast recovery times are important.

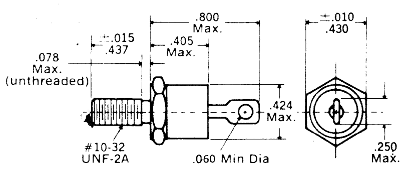
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	JAN, JANTX, JANTXV 1N5812
100V	JAN, JANTX, JANTXV, 1N5814
150V	JAN, JANTX, JANTXV 1N5816

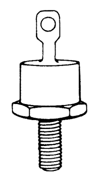
Maximum Average D.C. Output Current
@ $T_C = 100°C$ 20A
@ $T_A = 55°C$ 5A
Non-Repetitive Sinusoidal
Surge Current @ 8.3mSec 400A
Thermal Resistance, Junction to Case .... 1.5°C/W
Operating Junction Temperature .... −65°C to +175°C
Storage Ambient Temperature .... −65°C to +200°C

MECHANICAL SPECIFICATIONS

J, JTX, JTXV 1N5812, 1N5814, 1N5816



DO-4



Notes:
1. Polarity is cathode-to-stud.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 15 inch pounds.
4. Angular orientation of terminal is undefined.

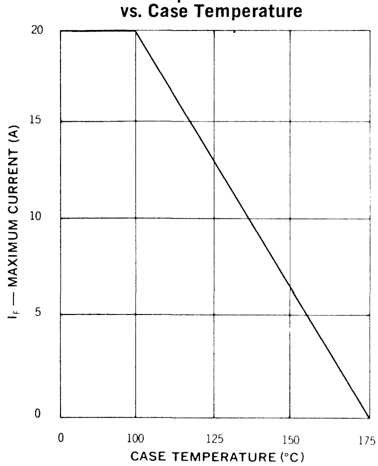
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

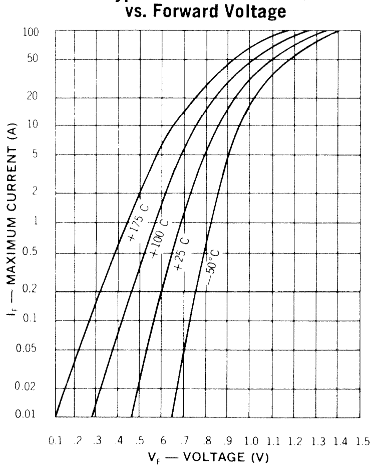
Type	Peak Inverse Voltage	Minimum Reverse Breakdown Voltage @ 100μA	Peak Forward Voltage		Maximum Leakage Current @ PIV	
			@ 10Apk	@ 20Apk	25°C	100°C
J, JTX, JTXV 1N5812	50V	60V	.86V MAX.	.95V MAX.	10μA	750μA
J, JTX, JTXV 1N5814	100V	110V				
J, JTX, JTXV 1N5816	150V	160V				

Maximum Reverse Recovery Time @ I_F, I_R, I_{REC}	Maximum Forward Recovery Time @ 1A Recovery to 1V	Maximum Forward Recovery Voltage @ 1A tr = 8nsec	Maximum Junction Capacitance @ −10V
35nsec 1.0A −1.0A −0.1A	15nsec	2.2V	300pf

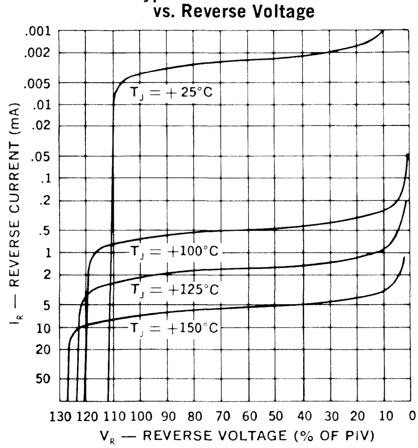
Output Current vs. Case Temperature



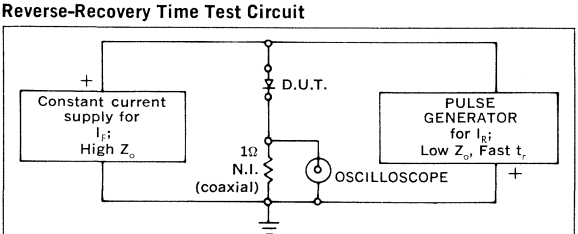
Typical Forward Current vs. Forward Voltage



Typical Reverse Current vs. Reverse Voltage



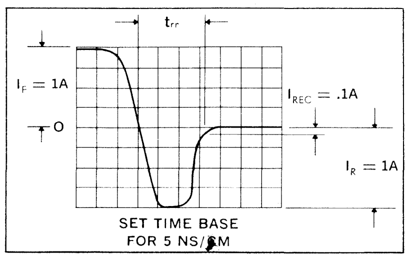
Reverse-Recovery Time Test Circuit



NOTES:

1. Oscilloscope: Rise time ≤ 3 ns; input impedance = 50 Ω.
2. Pulse Generator: Rise time ≤ 8 ns; source impedance 10 Ω.

Characteristic Waveform



UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

SCRs
1.25 Amp, Planar

2N1870A-2N1874A

FEATURES

- Available as Either "JAN" or Standard Types
- Operating D.C. Current Range: 5 to 1250mA
- Pulse Currents: to 30A
- Voltage Ratings: to 200V
- Maximum Trigger Current: 0.2mA
- Maximum Trigger Voltage: 0.8V
- All Leads Isolated from Case
- Maximum θ_{J-C}: 20°C/W

DESCRIPTION

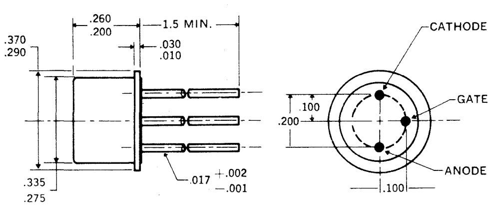
These are premium PNPN controlled switches intended for use in applications requiring a high degree of reliability assurance. The JAN types are specified under MIL-S-19500/198, and are included in MIL-STD-701 as recommended types for military usage.
This series is useful in a wide variety of applications including: safety, arming and detonating circuits; timing and programming circuits; protective and warning circuits; driving relays; driving indicator lamps, encoding and decoding circuits; replacing relays, thyratrons, and magamps; servo motor control; pulse generation; plus many others.

ABSOLUTE MAXIMUM RATINGS

	2N1870A JAN2N1870A	2N1871A JAN2N1871A	2N1872A JAN2N1872A	2N1873A —	2N1874A JAN2N1874A
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
D.C. On-State Current, I_T					
100°C Ambient			250mA		
100°C Case			1.25A		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current, $I_{G(AV)}$			25mA		
Reverse Gate Voltage, V_{GR}			5V		
Thermal Resistance, Junction to Case, $R\theta_{J-C}$			20°C/W		
Operating and Storage Temperature Range			−65°C to +150°C		

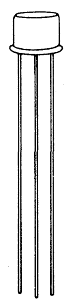
MECHANICAL SPECIFICATIONS

2N1870A-2N1874A



Dimensions in inches.

TO-9



UNITRODE

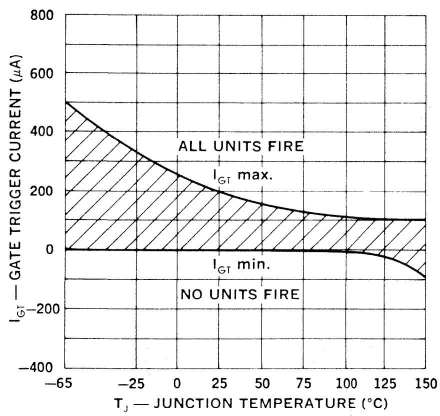
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	10	μA	R_{GK} = 1K, V_{DRM} = + Rating
Reverse Current	I_{RRM}	—	0.5	10	μA	R_{GK} = 1K, V_{RRM} = — Rating
Gate Trigger Voltage	V_{GT}	0.4	0.55	0.8	V	R_{GS} = 100 ohms, V_D = 5V
Gate Trigger Current	I_{GT}	—	30	200	μA	R_{GS} > 10K ohms, V_D = 5V
On-State Voltage	V_{TM}	—	1.8	2.5	V	I_{TM} = 2A (pulse test)
Off-State Voltage — Critical of Rise	dv_c/dt	100	—	—	V/μs	Specified test circuit
Reverse Gate Current	I_{GR}	—	0.5	10	μA	V_{GRM} = 5V, anode open
Holding Current	I_H	0.3	—	5.0	mA	I_G = — 150μA, V_D = 5V
Subgroup 3 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	15	100	μA	R_{GK} = 1K, V_{DRM} = + Rating
High Temp. Reverse Current	I_{RRM}	—	15	100	μA	R_{GK} = 1K, V_{RRM} = — Rating
High Temp. Gate Non-Trigger Voltage	V_{GD}	0.2	—	—	V	R_{GS} = 100 ohms, V_D = 5V
High Temp. Holding Current	I_H	0.2	—	—	mA	I_G = — 150μA, V_D = 5V
Subgroup 4 (—65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	—	—	1.0	V	R_{GK} = 100 ohms, V_D = 5V
Low Temp. Gate Trigger Current	I_{GT}	—	—	500	μA	R_{GK} > 10K ohms, V_D = 5V
Low Temp. Holding Current	I_H	—	—	15	mA	I_G = — 150μA, V_{AA} = 5V

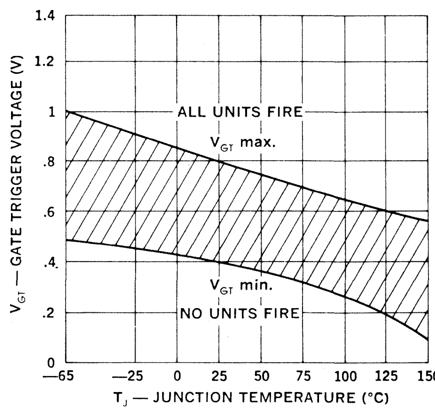
†All values in this table are JEDEC registered.
Note: Voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1 K or smaller, or other adequate gate bias is used.

Triggering and Bias Stabilization

1. Gate Trigger Current

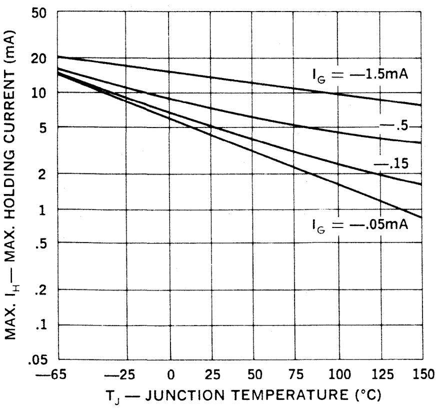


2. Gate Trigger Voltage

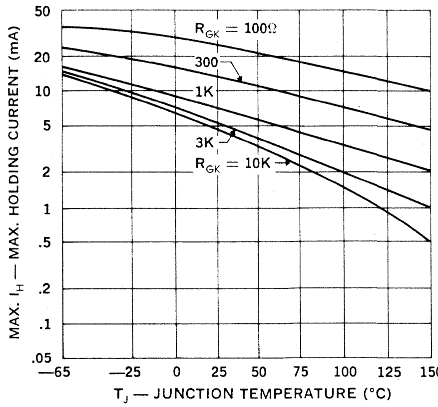


Holding Current

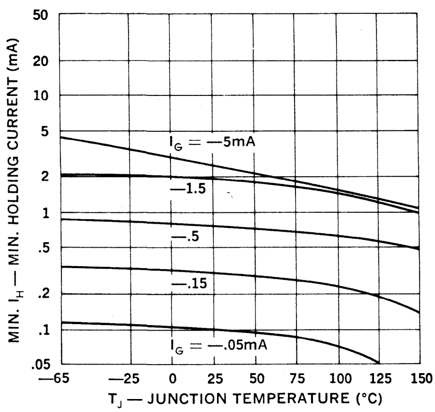
1. Max. Holding Current (Current Bias)



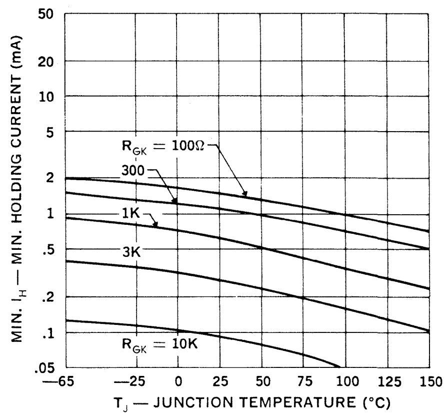
2. Max. Holding Current (Resistor Bias)



3. Min. Holding Current (Current Bias)

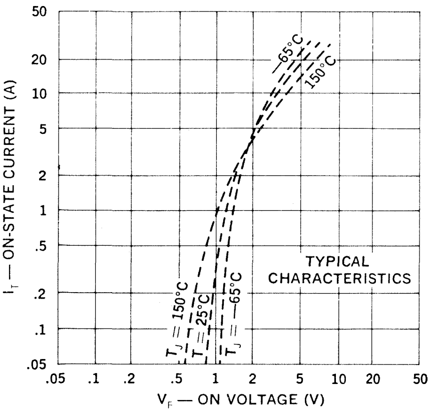


4. Min. Holding Current (Resistor Bias)

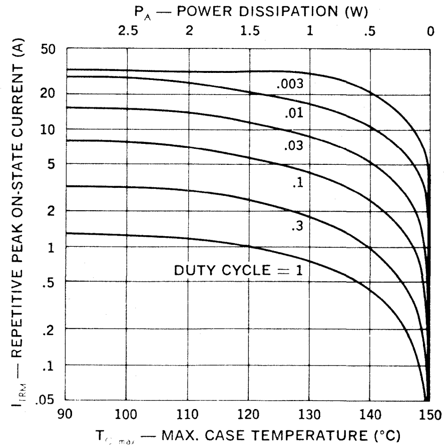


Current Ratings — Thermal Design

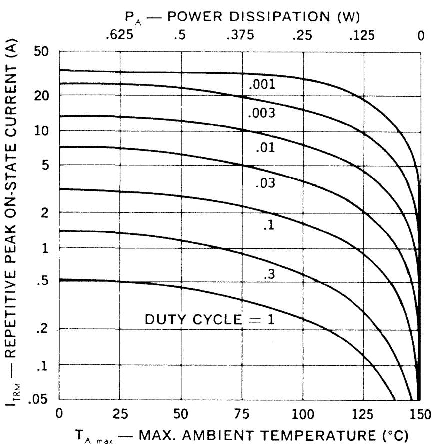
1. On-State Current vs. Voltage



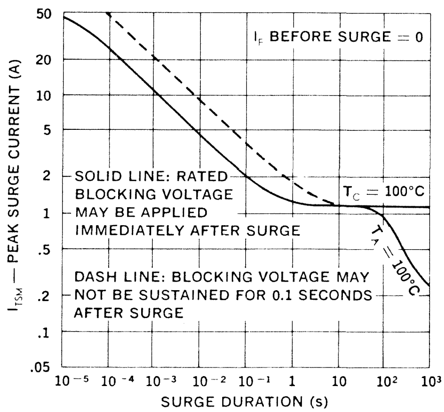
2. Peak Current vs. Case Temperature



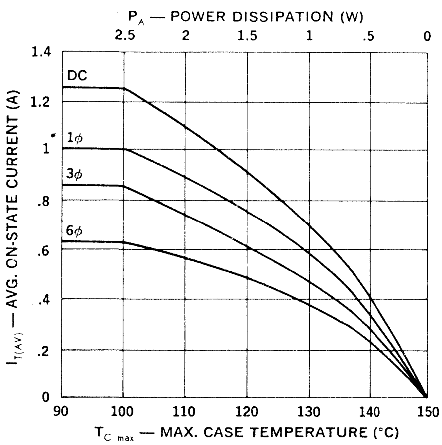
3. Peak Current vs. Ambient Temperature



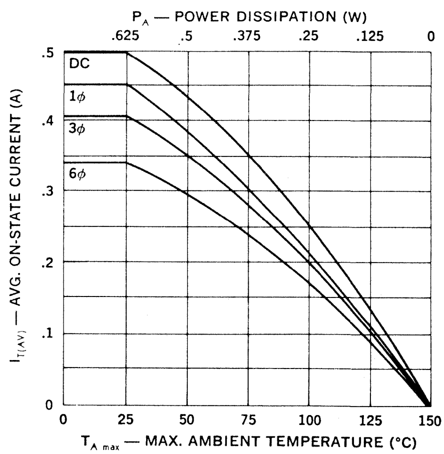
4. Surge Current vs. Time



5. Average Current vs. Case Temperature



6. Average Current vs. Ambient Temperature



SCRs
1.25 Amp, Planar

FEATURES
- Operating D.C. Current Range: 10-1250mA
- Peak Pulse Current: to 30A
- Maximum Gate Current to Fire: 20μA
- Firing Voltage: .52$\pm$.08V
- Voltage Ratings: to 200V
- "Turn-on" Time: Typically 0.1μs
- Low On Voltage: 2.5V Maximum at 2A

DESCRIPTION
This high sensitivity series, featuring very precise control of triggering characteristics, is particularly useful for timing and time delay circuits, voltage limit detectors, high gain static switching, logic circuits, pulse and sweep generators, and related applications.

This series is available in a TO-9 package, with all leads isolated from the case, providing a maximum thermal resistance of 20°C/Watt between junction and case.

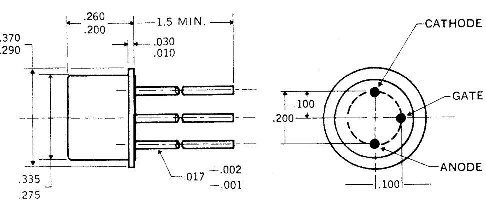
ABSOLUTE MAXIMUM RATINGS

	2N1875	2N1876	2N1877	2N1878	2N1879	2N1880
Repetitive Peak Off-State Voltage, V_{DRM}	15V	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	15V	30V	60V	100V	150V	200V

D.C. On-State Current, I_T	
100°C Ambient	250mA
100°C Case	1.25A
Repetitive Peak On-State Current, I_{TRM}	up to 30A
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A
Peak Gate Current, I_{GM}	250mA
Average Gate Current, $I_{G(AV)}$	25mA
Reverse Gate Voltage, V_{GR}	5V
Thermal Resistance, Junction to Case, $R\Theta_{J-C}$	20°C/W
Operating and Storage Temperature Range	−65°C to +150°C

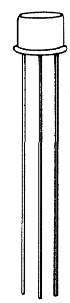
MECHANICAL SPECIFICATIONS

2N1875-2N1880



Dimensions in inches.

TO-9



UNITRODE

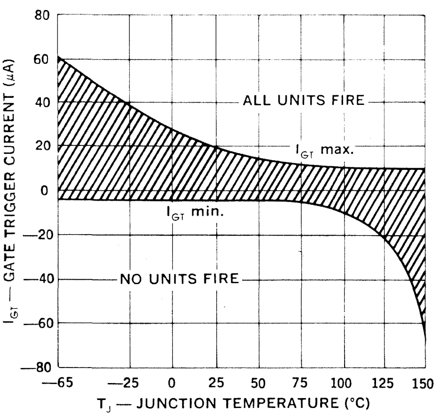
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	5	μA	V_{DRM} = Rating, R_{GK} = 1K
Reverse Current	I_{RRM}	—	0.5	10	μA	V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.5	10	μA	V_{GR} = 2V
Gate Trigger Current	I_{GT}	—	5	20	μA	V_D = 5V, R_{GS} = 10K
Gate Trigger Voltage	V_{GT}	.44	.52	.60	V	V_D = 5V, R_{GS} = 100Ω
Anode Trigger Current (Note 2)	I_{AT}	—	100	—	μA	V_D = 5V
On-State Voltage	V_T	0.8	1.8	2.5	V	I_T = 2A (Pulse Test)
Holding Current	I_H	0.3	1.0	3	mA	I_G = —150μA, V_{AA} = 5V
Subgroup 3 (25°C Tests)						
Turn-on Time	t_{on}	—	0.1	—	μs	I_G = 20mA
Turn-off Time	t_{off}	—	0.5	—	μs	I_T = .5A
Gate Trigger — on Pulse Width	$t_{pg(on)}$	—	0.5	—	μs	V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	10	—	μs	I_T = .5A, i_R = .5A, R_{GK} = 1K
Subgroup 4 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	5	20	μA	V_D = Rating, R_{GK} = 1K
High Temp. Reverse Current	I_{RRM}	—	15	100	μA	V_{RRM} = Rating

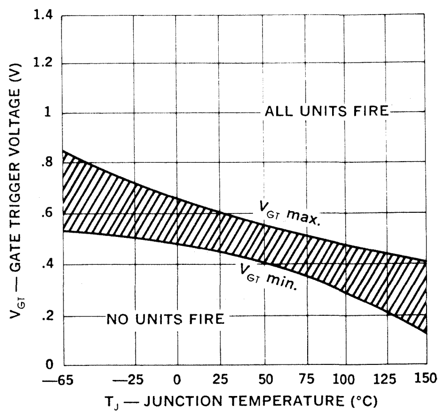
Note: 1. Voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used.
2. For a maximum limit of 50μA, use suffix "—1" and drop "2N". Example: 1877-1.
† All values in this table are JEDEC registered.

TRIGGERING AND BIAS STABILIZATION

1. Gate Trigger Current



2. Gate Trigger Voltage



SCRs

2N1881-2N1885

1 Amp, Planar

FEATURES

- One Cycle Surge Current: 15A
- Voltage Ratings: to 200V
- Low "On-Voltage": 2V Max. at 1A
- Operation: to 150°C Junction Temperature
- All Leads Isolated for Design Flexibility

DESCRIPTION

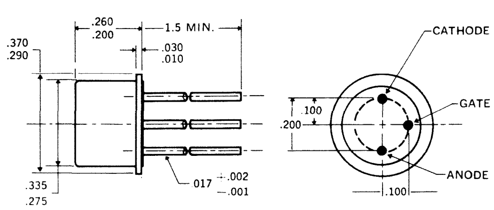
These types are useful in AC and DC static switching, proportioning control, relay and thyratron replacement, DC to AC converters, servo motor driving, protective circuits, and related applications.
This series is available in a TO-9 package, with all leads isolated from the case, providing a maximum thermal resistance of 20°C/Watt between junction and case.

ABSOLUTE MAXIMUM RATINGS

	2N1881	2N1882	2N1883	2N1884	2N1885
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
D.C. On-State Current, I_T					
100°C Ambient			250mA		
100°C Case			1.0A		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current $I_{G(AV)}$			25mA		
Reverse Gate Voltage, V_{GR}			3V		
Thermal Resistance, Junction to Case, $R\Theta_{J-C}$			20°C/W		
Operating and Storage Temperature Range			—65°C to +150°C		

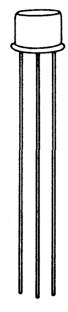
MECHANICAL SPECIFICATIONS

2N1881-2N1885



Dimensions in inches.

TO-9



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Subgroup 1 (Visual and Mechanical)						
Subgroup 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	0.5	10	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	0.5	10	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.5	10	μA	$V_{GRM} = 2V$
Gate Trigger Current	I_{GT}	—	0.2	2	mA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.40	1	2	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.5	2	V	$I_T = 1A$ (pulse test)
Holding Current	I_H	—	2	—	mA	$I_G = -150\mu A$, $V_D = 5V$
Anode Trigger Current	I_{AT}	—	0.5	—	mA	$R_{GS} = 10K$, $V_D = 5V$
Subgroup 3 (25°C Tests)						
Turn-on Time	t_{on}	—	0.2	—	μs	$I_G = 20mA$, $I_T = 0.5A$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	1	—	μs	$I_G = 20mA$, $I_T = 0.5A$, $V_D = 30V$
Turn-off Time	t_{off}	—	1	—	μs	$I_T = 1A$, $I_R = IA$, $R_{GK} = IK$
Circuit Commutated Turn-off Time	t_q	—	10	—	μs	$I_T = 1A$, $I_R = IA$, $R_{GK} = IK$
Subgroup 3 (125°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	15	200	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	15	200	μA	$R_{GK} = 1K$, V_{RRM} = Rating

† All values in this table are JEDEC registered.

Note: Voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used.

POWER TRANSISTORS

2 Amp, 80V, Planar NPN

JAN & JANTX 2N2151

FEATURES

- Meets MIL-S-19500/277
- Collector-Base Voltage: up to 150V
- D.C. Collector Current: 2A
- Beta Guaranteed at 3 Current Levels
- Characterized for Safe Operating Area

DESCRIPTION

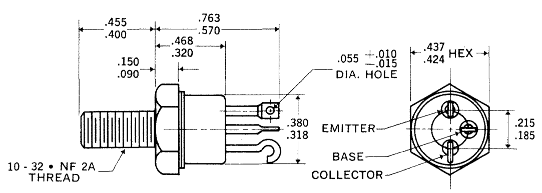
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N2151
Collector-Base Voltage, V_{CBO}	150V
Collector-Emitter Voltage, V_{CEO}	100V
Emitter-Base Voltage, V_{EBO}	8V
D.C. Collector Current, I_C	2A
Base Current, I_B	2A
Power Dissipation	
100°C Case	30W
Operating Temperature Range	—55°C to 175°C
Storage Temperature Range	—65°C to 200°C

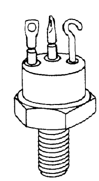
MECHANICAL SPECIFICATIONS

JAN & JANTX2N2151



Dimensions in inches.

TO-59



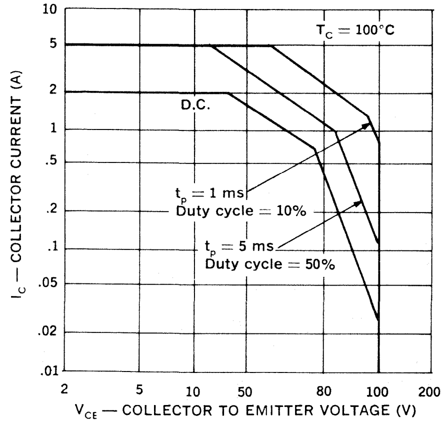
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

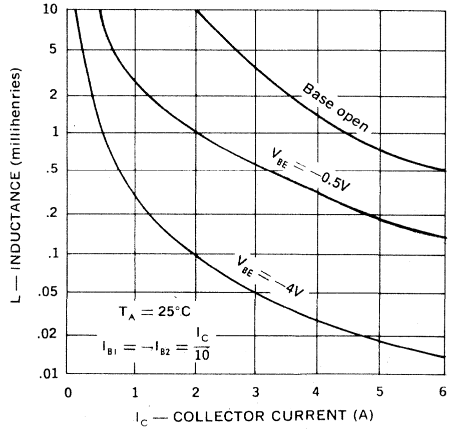
Test	Symbol	Min.	Max.	Units	/277C Sub-group	Method	MIL-STD-750 Test Conditions
25°C							
Collector-Base Breakdown Voltage	BV_{CBO}	150	—	Vdc	A-2	3001	$I_C = 100uAdc$, Cond. D
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	100	—	Vdc	A-2	3011	$I_C = 50mAdc$, Cond. D
Collector-Emitter Cutoff Current	I_{CES}	—	5	uAdc	A-2	3041	$V_{CE} = 120Vdc$, $V_{BE} = 0$, Cond. C
Collector-Emitter Cutoff Current	I_{CEX}	—	5	uAdc	A-2	3041	$V_{CE} = 120Vdc$, $V_{EB} = 1Vdc$, Cond. A
Collector-Emitter Cutoff Current	I_{CEO}	—	10	uAdc	A-2	3041	$V_{CE} = 80Vdc$, Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	5	uAdc	A-2	3036	$V_{CB} = 120Vdc$, Cond. D
Emitter-Base Cutoff Current	I_{EBO}	—	2	uAdc	A-2	3061	$V_{EB} = 8Vdc$, Cond. D
D.C. Current Gain (Note 1)	h_{FE}	40	120	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	40	120	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	40	—	—	A-3	3076	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	0.1	1.0	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$, Cond. A
Base-Emitter Voltage (Note 1)	V_{BE}	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $V_{CE} = 5Vdc$, Cond. B
A.C. Current Gain	h_{fe}	40	160	—	A-5	3206	$I_C = 0.1Adc$, $V_{CE} = 30Vdc$, $f = 1kHz$
Gain-Bandwidth Product	f_T	10	70	MHz	A-5	3306	$I_C = 0.1Adc$, $V_{CE} = 30Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	160	pf	A-5	3236	$V_{CB} = 20Vdc$, $I_E = 0$, $f = 1MH_Z$
Thermal Resistance	θ_{J-C}	—	2.5	$^{o}C/W$	C-1	3151	
100°C							
Forward-Biased Second Breakdown	$I_{S/B}$	2	—	Adc	B-9	—	$V_{CE} = 15Vdc$, $t = 60$ sec, see curve
Forward-Biased Second Breakdown	$I_{S/B}$	200	—	mAdc	B-9	—	$V_{CE} = 57Vdc$, $t = 60$ sec, see curve
Forward-Biased Second Breakdown	$I_{S/B}$	25	—	mAdc	B-9	—	$V_{CE} = 100Vdc$, $t = 60$ sec, see curve
Unclamped Inductive Sweep	$E_{S/B}$	20	—	mj	B-5	—	$I_C = 2Adc$, $L = 10mh$
Clamped Inductive Sweep	$E_{S/B}$	80	—	mj	B-6	—	$I_C = 2Adc$, $L = 40mh$, $V_{clamp} = 150V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}	—	100	uAdc	A-4	3041	$V_{CE} = 120Vdc$, $V_{BE} = 0$, Cond. C
Collector-Emitter Cutoff Current	I_{CEX}	—	100	uAdc	A-4	3041	$V_{CE} = 120Vdc$, $V_{EB} = 1Vdc$
Emitter-Base Cutoff Current	I_{EBO}	—	20	uAdc	A-4	3061	$V_{EB} = 8Vdc$, Cond. D
−55°C							
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	A-4	3076	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$

Note: 1. Pulse length = 300 μs; duty cycle $\leqslant 2\%$.

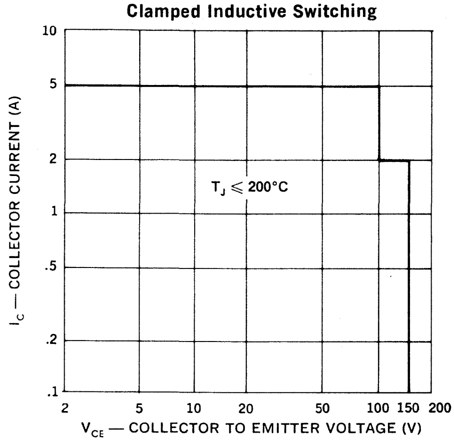
Forward Bias Safe Operating Area



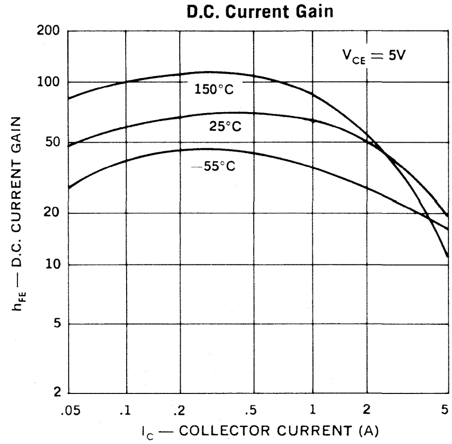
Unclamped Reverse Bias Second Breakdown



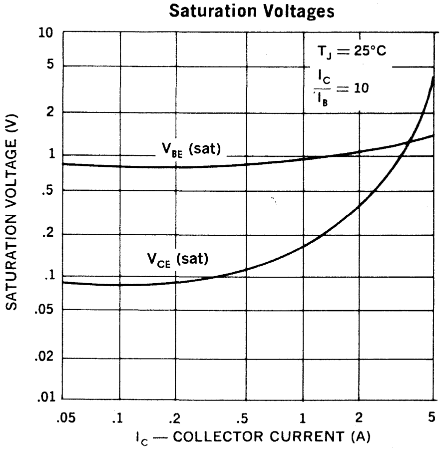
Reverse Bias Safe Operating Area Clamped Inductive Switching



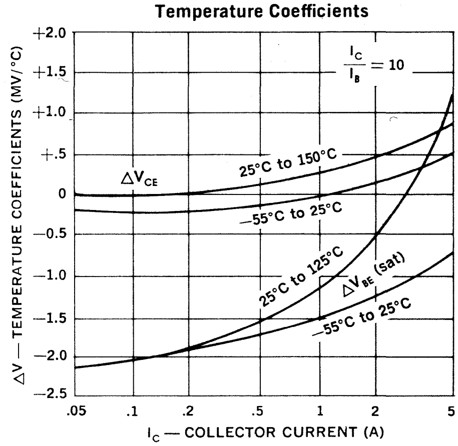
D.C. Current Gain

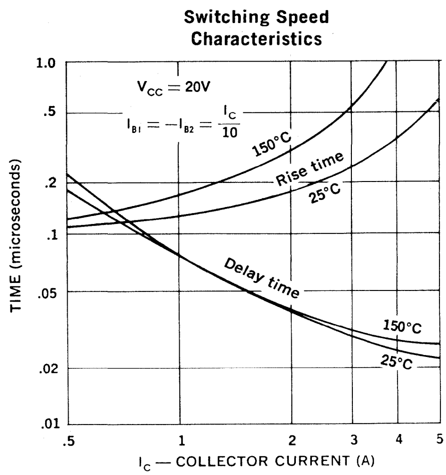


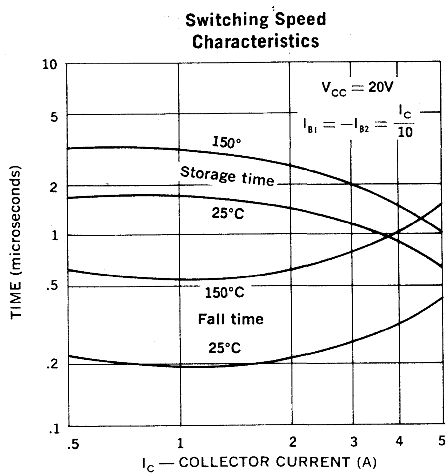
Saturation Voltages

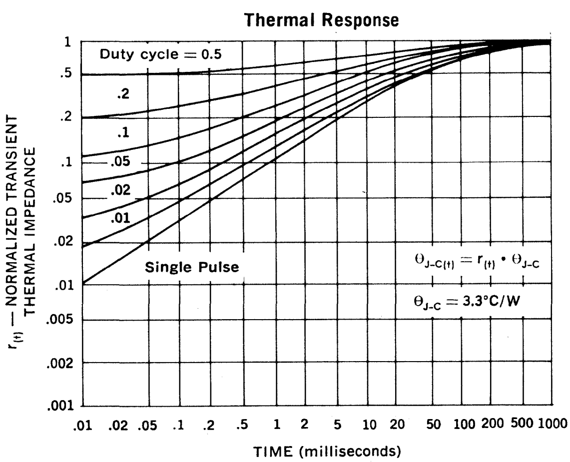


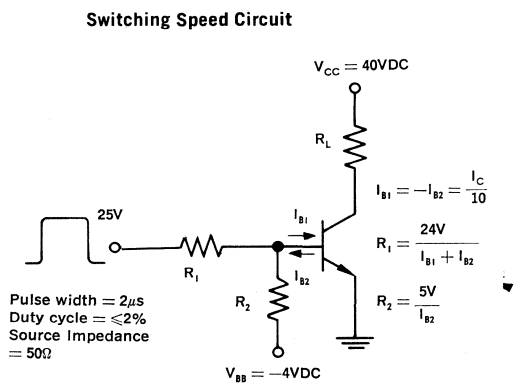
Saturation Voltage Temperature Coefficients




Switching Speed Characteristics
$V_{CC} = 20V$
$I_{B1} = -I_{B2} = \frac{I_C}{10}$
150°C
Rise time
25°C
Delay time
150°C
25°C
TIME (microseconds)
1.0
.5
.2
.1
.05
.02
.01
.5
1
2
3
4
5
I_C — COLLECTOR CURRENT (A)


Switching Speed Characteristics
$V_{CC} = 20V$
$I_{B1} = -I_{B2} = \frac{I_C}{10}$
150°
Storage time
25°C
150°C
Fall time
25°C
TIME (microseconds)
10
5
2
1
.5
.2
.1
.5
1
2
3
4
5
I_C — COLLECTOR CURRENT (A)


Thermal Response
Duty cycle = 0.5
.2
.1
.05
.02
.01
Single Pulse
$\theta_{J-C(t)} = r_{(t)} \cdot \theta_{J-C}$
$\theta_{J-C} = 3.3°C/W$
$r_{(t)}$ — NORMALIZED TRANSIENT THERMAL IMPEDANCE
1
.5
.2
.1
.05
.02
.01
.005
.002
.001
.01
.02
.05
.1
.2
.5
1
2
5
10
20
50
100
200
500
1000
TIME (milliseconds)


Switching Speed Circuit
$V_{CC} = 40VDC$
R_L
$I_{B1} = -I_{B2} = \frac{I_C}{10}$
25V
I_{B1}
$R_1 = \frac{24V}{I_{B1} + I_{B2}}$
R_1
I_{B2}
R_2
$R_2 = \frac{5V}{I_{B2}}$
Pulse width = 2μs
Duty cycle = ≤2%
Source Impedance = 50Ω
$V_{BB} = -4VDC$

SCRs
1.6 Amp, Planar

2N2322-2N2329
2N2323A-2N2328A

FEATURES
- Available as JAN & JANTX Types
- 1.6A D.C. Current
- Peak Currents: to 30A
- Voltage Ratings: to 400V
- 20μA Max. Trigger Current ("A" types)
- 0.6V Max. Trigger Voltage ("A" types)

DESCRIPTION
These are premium thyristor switches intended for use in high performance industrial, military and space applications requiring a high degree of reliability assurance. This series is useful in a wide variety of applications including timing and programming circuits, protective and warning circuits, driving relays, driving indicator lamps, encoding and decoding circuits, replacing relays, thyratrons, and magamps, servo motor control, pulse generation, plus many others. The high surge current rating (15A - 1 cycle) makes this series particularly useful for squib firing.

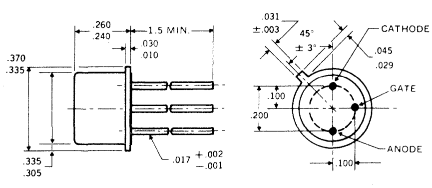
The following JAN and JANTX types are specified under Mil-S-19500/276A and are included in Mil-STD-701 as recommended types for military usage:

ABSOLUTE MAXIMUM RATINGS

	2N2322	2N2323 JAN2N2323 JANTX2N2323 2N2323A JAN2N2323A JANTX2N2323A	2N2324 JAN2N2324 JANTX2N2324 2N2324A JAN2N2324A JANTX2N2324A	2N2325 2N2325A	2N2326 JAN2N2326 JANTX2N2326 2N2326A JAN2N2326A JANTX2N2326A	2N2327 2N2327A	2N2328 JAN2N2328 JANTX2N2328 2N2328A JAN2N2328A JANTX2N2328A	2N2329 JAN2N2329 JANTX2N2329
Repetitive Peak Off-State Voltage, V_{DRM}	25V	50V	100V	150V	200V	250V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	25V	50V	100V	150V	200V	250V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM} (< 5ms)	40V	75V	150V	225V	300V	350V	400V	500V
D.C. On-State Current, I_T								
80°C Ambient	300mA							
85°C Case	1.6A							
One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	15A							
Repetitive Peak On-State Current, I_{TM}	30A							
Gate Power Dissipation, P_{GM}	0.1W							
Gate Power Dissipation, $P_{GM(AV)}$	0.01W							
Peak Gate Current, I_{GM}	100mA							
Peak Gate Voltage, Forward and Reverse	6V							
Reverse Gate Current, I_{GR}	3mA							
Storage Temperature Range	−65°C to +150°C							
Operating Temperature Range	−65°C to +125°C							

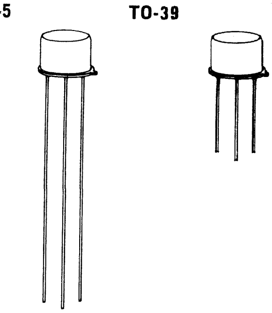
MECHANICAL SPECIFICATIONS

2N2322-2N2329 2N2323A-2N2328A



Dimensions in inches. TO-39 has .5" lead length

TO-5 **TO-39**



Non JAN types available in TO-39 package

UNITRODE

ELECTRICAL SPECIFICATIONS

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Visual and Mechanical						MIL-STD-750, Method 2071
25°C						
Off-State Current	I_{DRM}	—	0.1	10	μA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	0.1	10	μA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Current	I_{GT}					
"A" Types		—	2	20	μA	V_D = 6V, R_L = 100Ω
non-"A" Types		—	50	200	μA	V_D = 6V, R_L = 100Ω
Gate Trigger Voltage	V_{GT}					
"A" Types		0.35	0.52	0.60	V	V_D = 6V, R_{GK} = 2K, R_L = 100Ω
non-"A" Types		0.35	0.55	0.80	V	V_D = 6V, R_{GK} = 1K, R_L = 100Ω
On-State Voltage	V_{TM}	—	2.0	2.2	V	I_{TM} = 4A (pulse test)
Holding Current	I_H	—	0.3	2.0	mA	V_D = 6V, R_{GK} = 1K (2K for "A" Types)
Reverse Gate Current	I_{GR}	—	1	200*	μA	V_{GR} = 6V
Delay Time	t_d	—	0.6	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Rise Time	t_r	—	0.4	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-Off Time	t_q	—	20	—	μs	I_T = 1A, I_R = 1A, R_{GK} = 1K
125°C						
Off-State Current	I_{DRM}	—	1	100	μA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	1	100	μA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Voltage	V_{GT}	0.1	0.3	—	V	V_D = Rated V_D, R_{GK} = 1K (2K for "A" Types)
Holding Current	I_H					
"A" Types		0.1†	—	—	mA	V_D = 6V, R_{GK} = 2K
non-"A" Types		0.15†	—	—	mA	V_D = 6V, R_{GK} = 1K
Off-State Voltage — Critical Rate of Rise	dv/dt					
"A" Types		0.7*			V/μs	V_D = Rating, R_{GK} = 2K
non-"A" Types		1.8*			V/μs	V_D = Rating, R_{GK} = 1K
−65°C						
Off-State Current	I_{DRM}	—	.05	5.0*	μA	V_{DRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Reverse Current	I_{RRM}	—	.05	5.0*	μA	V_{RRM} = Rating, R_{GK} = 1K (2K for "A" Types)
Gate Trigger Current	I_{GT}					
"A" Types		—	50	75	μA	V_D = 6V, R_L = 100Ω
non-"A" Types		—	100	350	μA	V_D = 6V, R_L = 100Ω
Gate Trigger Voltage	V_{GT}					
"A" Types		—	0.7	0.8*	V	V_D = 6V, R_{GK} = 2K, R_L = 100Ω
				0.9†	V	V_D = 6V, R_{GK} = 2K, R_L = 100Ω
non-"A" Types		—	0.75	1.0	V	V_D = 6V, R_{GK} = 1K, R_L = 100Ω
Holding Current	I_H	—	—	3.0†	mA	V_D = 6V, R_{GK} = 1K (2K for "A" Types)

* JAN and JANTX Types only.
† Industrial Types only.

JAN and JANTX Acceptance Tests

100% Screening TX-Types

High Temperature Storage
Temperature Cycling
Constant Acceleration
Fine & Gross Hermetic Seal
Electrical Test
Burn-in
Electrical Test

Group B Tests

Subgroup 1 — Reverse Gate Current
Surge Current
Non-Repetitive Reverse Voltage

Subgroup 2 — Low Temp. Reverse Blocking Current
Low Temp. Forward Blocking Current
Low Temp. Gate Trigger Voltage
Low Temp. Gate Trigger Current

Subgroup 3 — Temperature Cycling
Thermal Shock
Moisture Resistance
Solderability

Subgroup 4 — Blocking Life Test

Group C Tests

Subgroup 1 — Physical Dimensions

Subgroup 2 — Shock
Constant Acceleration
Vibration, Variable Frequency

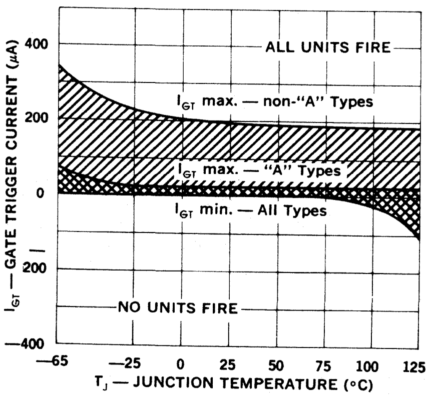
Subgroup 3 — Barometric Pressure, Reduced

Subgroup 4 — Salt Atmosphere

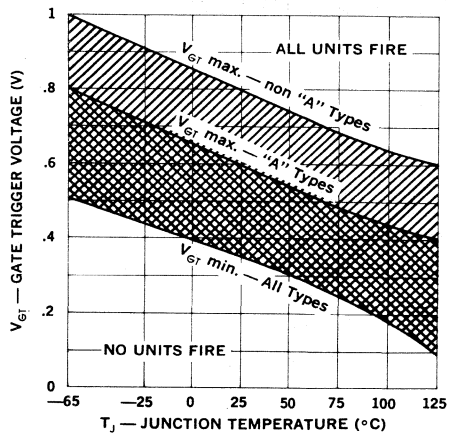
Subgroup 5 — Terminal Strength

Subgroup 6 — Intermittent Operating Life Test

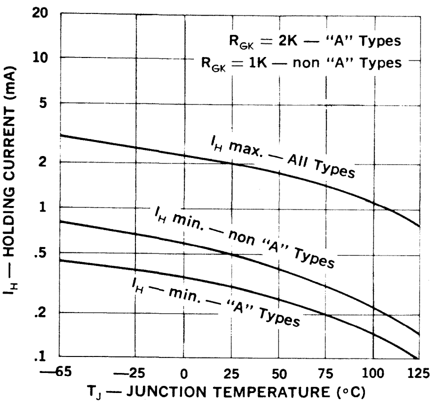
Gate Trigger Current



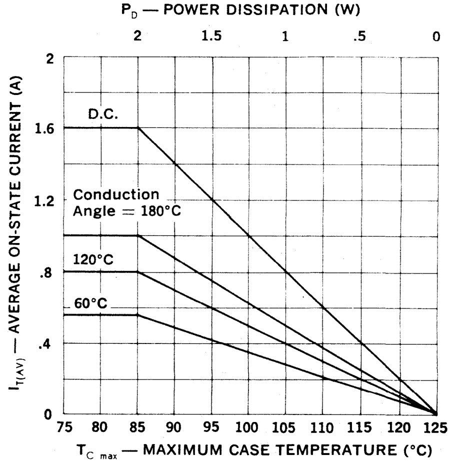
Gate Trigger Voltage



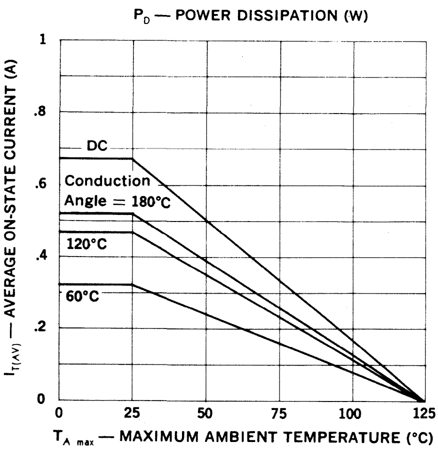
Holding Current



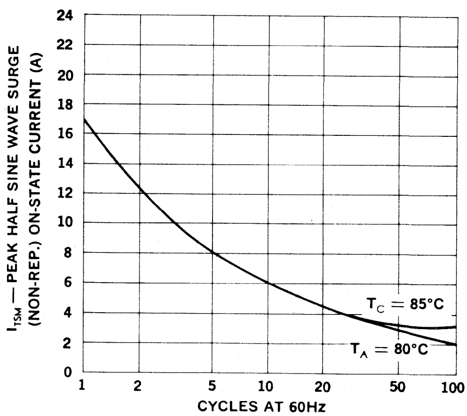
Average Current vs. Case Temperature



Average Current vs. Ambient Temperature



Surge Current



POWER TRANSISTORS
5 Amp, 80V, Planar, NPN

JAN, JANTX, & JANTXV 2N2880
JAN, JANTX, & JANTXV 2N3749

FEATURES
- Meets MIL-S-19500/315
- Collector-Base Voltage: 110V
- Fast Switching: t_r, t_f = 300nSec max
- Low Saturation Voltage: 0.25V max @ 1A

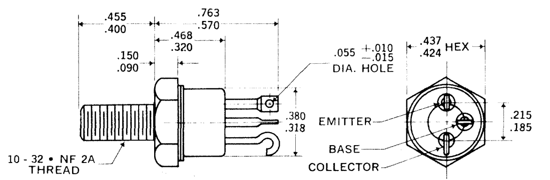
DESCRIPTION
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN, JANTX, JANTXV 2N2880 2N3749
Collector-Base Voltage, V_{CBO}	110V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	8V
D.C. Collector Current, I_C	5A
Power Dissipation	
25°C Ambient	2W
100°C Case	30W
Operating and Storage Temperature Range	−65°C to +200°C

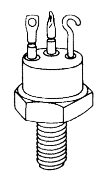
MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 2N2880

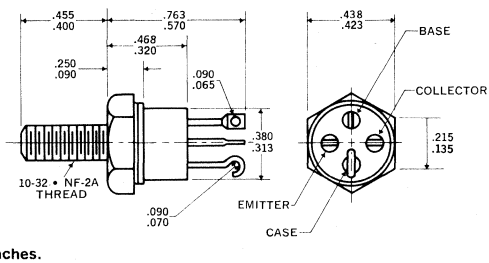


Dimensions in inches.

TO-59

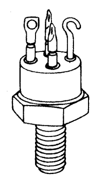


JAN, JANTX, & JANTXV 2N3749



Dimensions in inches.

TO-111



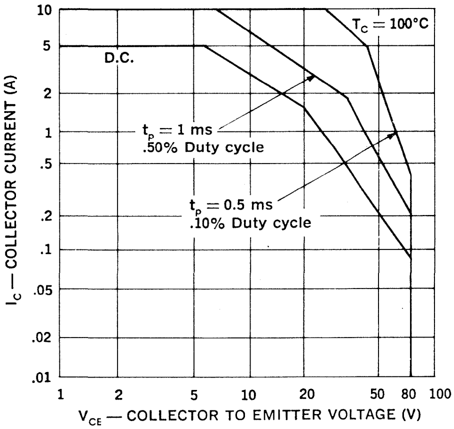
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

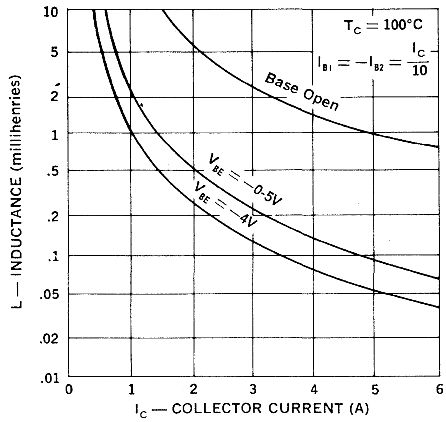
TEST	SYMBOL	MIN.	MAX.	UNITS	/315 Sub group	MIL - STD - 750 METHOD	TEST CONDITIONS
Visual and Mechanical	—	—	—		A-1	2071	See Mechanical Data
Collector-Base Voltage	BV_{CBO}	110	—	Vdc	A-2	3001	$I_C = 10\mu Adc$, Cond. D
Collector-Emitter Voltage (1.)	BV_{CEO}	80	—	Vdc	A-2	3011	$I_C = 0.1Adc$, Cond. D
Emitter-Base Voltage	BV_{EBO}	8	—	Vdc	A-2	3026	$I_E = 10\mu Adc$, Cond. D
Collector-Emitter Cutoff Current	I_{CEO}	—	100	μAdc	A-2	3041	$V_{CE} = 60Vdc$, Cond. D
Collector-Emitter Cutoff Current	I_{CEX}	—	10	μAdc	A-2	3041	$V_{CE} = 110Vdc$, $V_{EB} = 0.5Vdc$, Cond. A
Collector-Base Cutoff Current	I_{CBO}	—	0.4	μAdc	A-2	3036	$V_{CB} = 80Vdc$, Cond. D
Emitter-Base Cutoff Current	I_{EBO}	—	0.4	μAdc	A-2	3061	$V_{EB} = 6Vdc$, Cond. D
D.C. Current Gain (1.)	h_{FE}	40	—	—	A-3	3076	$I_C = 50mAdc$, $V_{CE} = 5Vdc$
D.C. Current Gain (1.)	h_{FE}	40	120	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (1.)	h_{FE}	15	—	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (1.)	$V_{CE(sat)}$	—	0.25	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Collector Saturation Voltage (1.)	$V_{CE(sat)}$	—	2	Vdc	A-3	3071	$I_C = 5Adc$, $I_B = 0.5Adc$
Base Saturation Voltage (1.)	$V_{BE(sat)}$	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$
Base On-Voltage (1.)	$V_{BE(on)}$	—	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $V_{CE} = 2Vdc$
A.C. Current Gain	h_{FE}	40	120	—	A-4	3206	$I_C = 50mAdc$, $V_{CE} = 5Vdc$, $f = 1KHz$
Gain-Bandwidth Product	f_T	20	120	MHz	A-4	3306	$I_C = 1Adc$, $V_{CE} = 10Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	150	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Switching Parameters							
Delay Time	t_d	—	60	ns	A-4	—	See Switching Speed Circuit
Rise Time	t_r	—	300	ns	A-4	—	See Switching Speed Circuit
Storage Time	t_s	—	1.7	μs	A-4	—	See Switching Speed Circuit
Fall Time	t_f	—	300	ns	A-4	—	See Switching Speed Circuit
Thermal Resistance	θ_{JC}	—	3.33	°C/W	C-1	3151	
100°C							
Forward-Biased Second Breakdown	$I_{S/B}$	5	—	Adc	B-5	3051	$V_{CE} = 6Vdc$, $t = 60Sec$, $T_C = 100°C$
Forward-Biased Second Breakdown	$I_{S/B}$	80	—	mAdc	B-5	3051	$V_{CE} = 80Vdc$, $t = 60Sec$, $T_C = 100°C$
Clamped Reverse-Biased Second Breakdown	$E_{S/B}$	12.5	—	mj	B-7	—	$I_C = 5A$, $L = 1mH$, $V_{Clamp} = 110V$, $T_C = 100°C$
Unclamped Revers -Biased Second Breakdown	$E_{S/B}$	12.5	—	mj	B-6	3053	$I_C = 5A$, $L = 1mH$ Base Open
Unclamped Reverse-Biased Second Breakdown	$E_{S/B}$	12.8	—	mj	B-6	3053	$I_C = 1.6A$, $L = 10mH$ Base Open
150°C							
Collector-Emitter Cutoff Current	I_{CEX}	—	50	μA	A-5	3041	$V_{CE} = 80Vdc$, $V_{EB} = 0.5Vdc$ Cond. A, $T_A = 150°C$
−65°C							
D.C. Current Gain (1.)	h_{FE}	15	—	—	A-5	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$ $T_A = -65°C$

Note 1. Pulse Width = 300μSec, duty cycle ≤ 2%

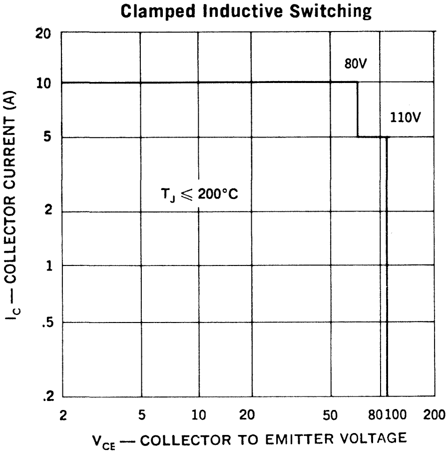
Forward Bias Safe Operating Area



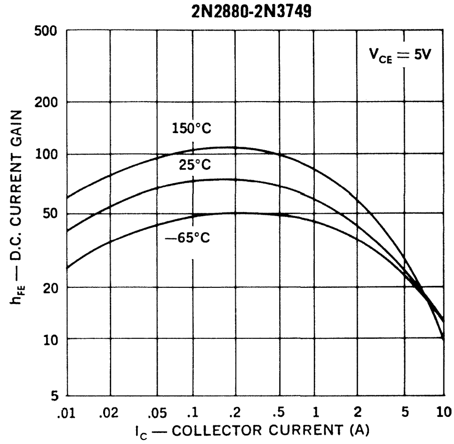
Unclamped Reverse Bias Second Breakdown



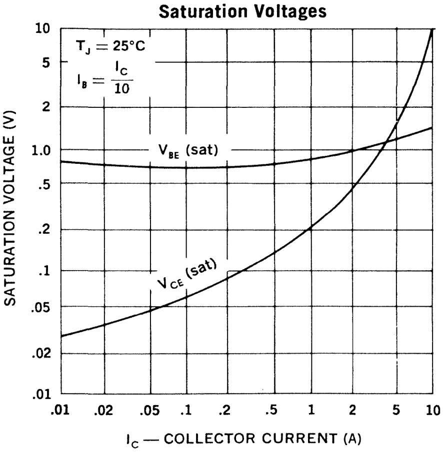
Reverse Bias Safe Operating Area Clamped Inductive Switching



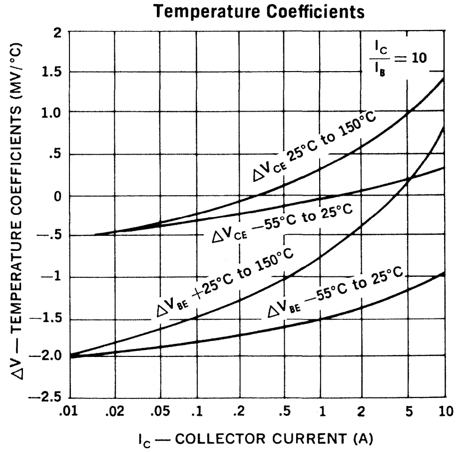
D.C. Current Gain 2N2880-2N3749



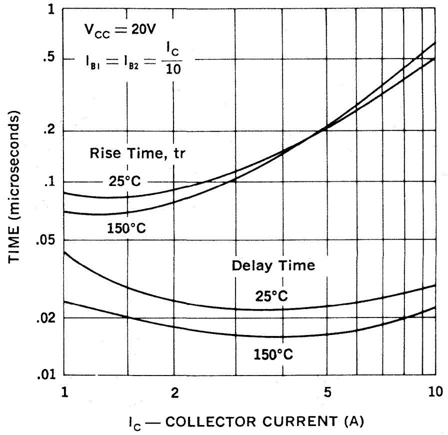
Saturation Voltages



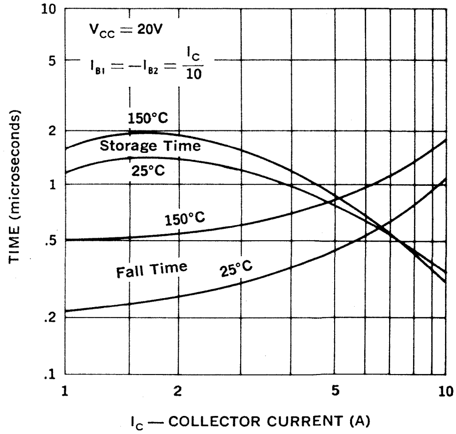
Saturation Voltage Temperature Coefficients



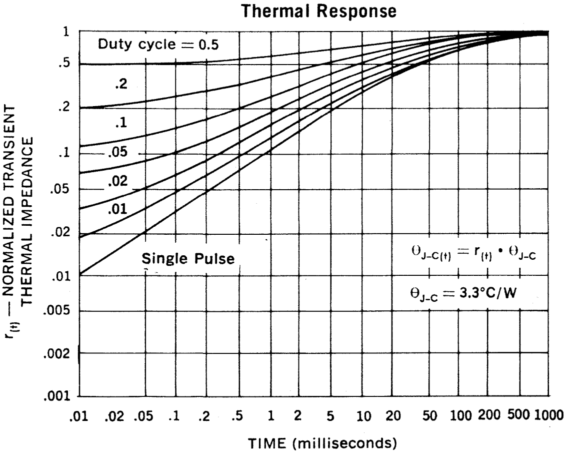
Switching Speed Characteristics



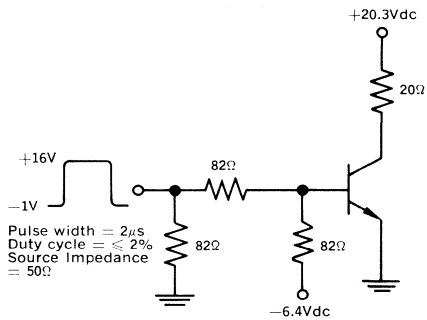
Switching Speed Characteristics



Thermal Response



Switching Speed Circuit



NOTES:

1. $I_C \approx 1A$, $I_{B1} \approx -I_{B2} \approx 100mA$
2. The values of collector current and base current are nominal. The actual values will vary slightly with transistor parameters.

SCRs

0.5 Amp, Planar

JAN & JANTX 2N3027-2N3032

FEATURES

- JAN and JANTX Types Available
- Fully Characterized for "Worst Case" Design
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity
- Low On-State Voltage and Fast Switching at High Current Levels
- Typical Turn-On Time: 0.12μs
- Typical Recovery Time: 0.7μs
- Pulse Currents: to 30A

DESCRIPTION

The 2N3027 series of planar SCRs (controlled switches) are intended for use in military and space applications requiring a high degree of reliability. They offer a unique combination of extremely fast switching, precise triggering, high pulse power, small size, intrinsic parameter stability, and high radiation tolerance.

The JAN and JANTX types are specified under MIL-S-19500/419, and are included in MIL-STD-701 as recommended types for military usage.

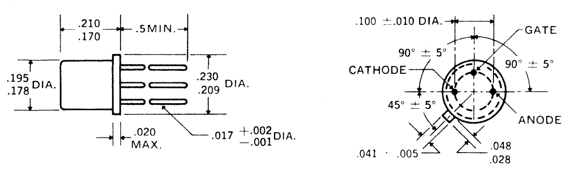
ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N3027 JAN & JANTX 2N3030	JAN & JANTX 2N3028 JAN & JANTX 2N3031	JAN & JANTX 2N3029 JAN & JANTX 2N3032
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V
D.C. On-State Current, I_T			
100°C Case		500mA	
75°C Ambient		250mA	
Repetitive Peak On-State Current, I_{TRM}		30A	
Surge (Non-Rep.) On-State Current, I_{TSM}			
50ms		5A	
8ms		8A	
Peak Gate Current, I_{GM}		250mA	
Average Gate Current, $I_{G(AV)}$		25mA	
Reverse Gate Voltage		5V	
Reverse Gate Current		3mA	
Storage Temperature Range		−65°C to +200°C	
Operating Temperature Range		−65°C to +150°C	

Note: Blocking voltage ratings apply over the operating temperature range, provided the gate is connected to the cathode through an appropriate resistor, or adequate gate bias is used. (See section on bias stabilization.)

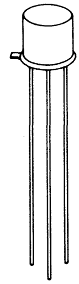
MECHANICAL SPECIFICATIONS

JAN & JANTX 2N3027-2N3032



Dimensions in inches.

TO18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N3027 — 2N3028 — 2N3029

Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						MIL-STD-750
Visual and Mechanical	—	—	—	—	—	Method 2071
SUBGROUP 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	.002	0.1	μA	R_{GK} = 1K, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.002	0.1	μA	R_{GK} = 1K, V_{RRM} = Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	I_{GR} = 0.1mA
Gate Trigger Current	I_{GT}	−5	8	200	μA	R_{GS} = 10K, V_D = 5V
Gate Trigger Voltage	V_{GT}	.40	.55	.80	V	R_{GS} = 100Ω, V_D = 5V
On-State Voltage	V_T	0.8	1.2	1.5	V	i_T = 1A (pulse test)
Holding Current	I_H	0.3	0.7	5.0	mA	R_{GK} = 1K, V_D = 5V
SUBGROUP 3 (25°C Tests)						
Off-State Voltage — Critical Rate of Rise	dv_c/dt	30	60	—	v/μs	R_{GK} = 1K, V_D = 30V
Gate Trigger-on Pulse Width	$t_{pg\,(on)}$	—	.07	0.2	μs	I_G = 10mA, I_T = 1A, V_{DM} = 30V
Delay Time	t_d	—	.08	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Rise Time	t_r	—	.04	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	0.7	2.0	μs	I_T = 1A, i_R = 1A, R_{GK} = 1K
SUBGROUP 4 (150°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	2	20	μA	R_{GK} = 1K, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	20	50	μA	R_{GK} = 1K, V_{RRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	.10	.15	0.6	V	R_{GS} = 100Ω, V_D = 5V
High Temp. Holding Current	I_H	.05	.20	1.0	mA	R_{GK} = 1K, V_D = 5V
SUBGROUP 5 (−65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	0.6	0.75	1.1	V	R_{GS} = 100Ω, V_D = 5V
Low Temp. Gate Trigger Current	I_{GT}	0	150	1.2	mA	R_{GS} = 10K, V_D = 5V
Low Temp. Holding Current	I_H	0.5	3.5	10	mA	R_{GK} = 1K, V_D = 5V

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N3030 — 2N3031 — 2N3032

Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						MIL-STD-750
Visual and Mechanical	—	—	—	—	—	Method 2071
SUBGROUP 2 (25°C Tests)						
Off-State Current	I_{DRM}	—	.002	0.1	μA	R_{GK} = 1K, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.002	0.1	μA	R_{GK} = 1K, V_{RRM} = Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	I_{GR} = 0.1mA
Gate Trigger Current	I_{GT}	−5		20	μA	R_{GS} = 10K, V_D = 5V
Gate Trigger Voltage	V_{GT}	0.44		0.6	V	R_{GS} = 100Ω, V_D = 5V
On-State Voltage	V_T	0.8	1.2	1.5	V	i_T = 1A (pulse test)
Holding Current	I_H	0.3	1.0	4.0	mA	R_{GK} = 1K, V_D = 5V
SUBGROUP 3 (25°C Tests)						
Off-State Voltage — Critical Rate of Rise	dv_c/dt	30	60	—	v/μs	R_{GK} = 1K, V_D = 30V
Gate Trigger-on Pulse Width	t_{pg} (on)	—	.05	0.1	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Delay Time	t_d	—	0.1	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Rise Time	t_r	—	.05	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	0.7	2.0	μs	I_T = 1A, i_R = 1A, R_{GK} = 1K
SUBGROUP 4 (150°C Tests)						
High Temp. Off-State Current	I_{DRM}	—	2	20	μA	R_{GK} = 1K, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	20	50	μA	R_{GK} = 1K, V_{RRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	.10	.15	0.4	V	R_{GS} = 100Ω, V_D = 5V
High Temp. Holding Current	I_H	.05	.30	2.0	mA	R_{GK} = 1K, V_D = 5V
SUBGROUP 5 (−65°C Tests)						
Low Temp. Gate Trigger Voltage	V_{GT}	0.44	0.8	0.95	V	R_{GS} = 100Ω, V_D = 5V
Low Temp. Gate Trigger Current	I_{GT}	0	0.4	0.5	mA	R_{GS} = 10K, V_D = 5V
Low Temp. Holding Current	I_H	0.5	5.0	8	mA	R_{GK} = 1K, V_D = 5V

High Reliability Processing

The 2N3027-2N3032 series provides a complete range of high reliability processing from the standard devices that undergo extensive electrical testing, through JAN and JANTX levels. 100% processing, Group B, and Group C tests for JAN and JANTX devices is shown below. For further details, see MIL-S-19500/419(EL).

100% Screening TX-Types

- High Temperature Storage
- Temperature Cycling
- Constant Acceleration
- Fine & Gross Hermetic Seal
- Electrical Test
- Burn-in
- Electrical Test

Group B Tests

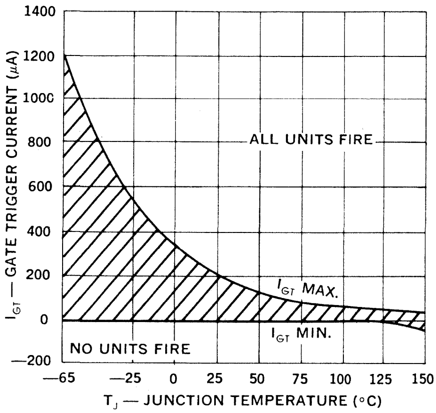
- Subgroup 1 — Physical Dimensions
- Subgroup 2 — Solderability
  - Temperature Cycling
  - Thermal Shock
  - Constant Acceleration
  - Moisture Resistance
- Subgroup 3 — Surge Current
- Subgroup 4 — Blocking Life Test
- Subgroup 5 — Storage Life Test
- Subgroup 6 — Operating Life Test

Group C Tests

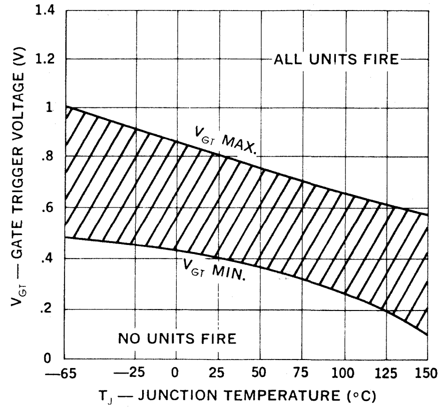
- Subgroup 1 — Shock
  - Vibration, Variable Frequency
- Subgroup 2 — Salt Atmosphere
- Subgroup 3 — Terminal Strength
- Subgroup 4 — High Temp. Anode Voltage — Critical rate or rise
- Subgroup 5 — Storage Life Test
- Subgroup 6 — Operating Life Test

TYPICAL CHARACTERISTICS
2N3027 — 2N3028 — 2N3029

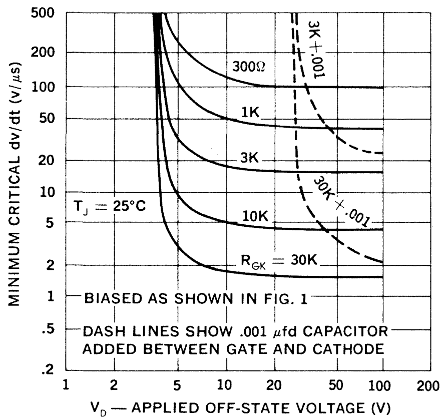
1 Gate Trigger Current



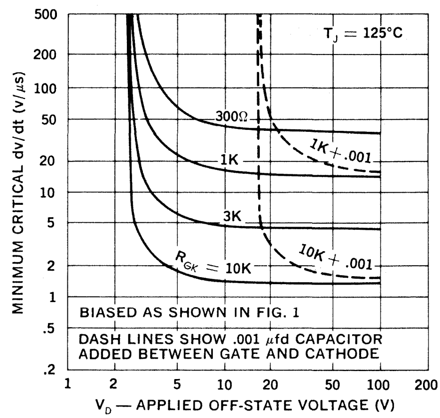
2 Gate Trigger Voltage



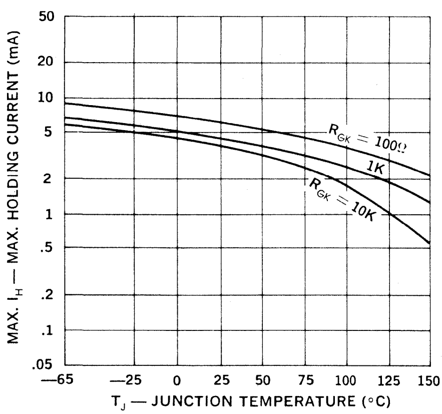
3 Min. Critical dv/dt (25°C — R Bias)



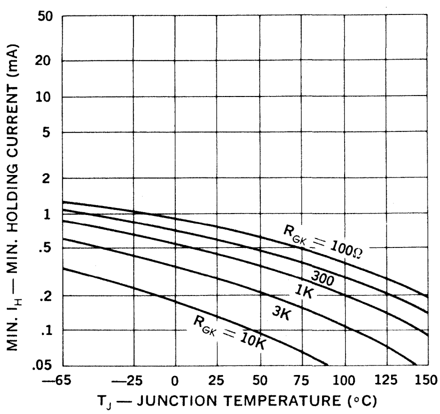
4 Min. Critical dv/dt (125°C — R Bias)



5 Max. Holding Current (Resistor Bias)

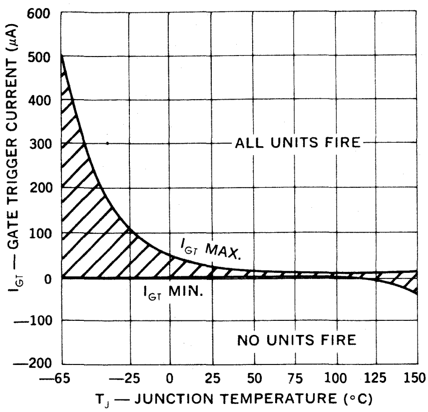


6 Min. Holding Current (Resistor Bias)

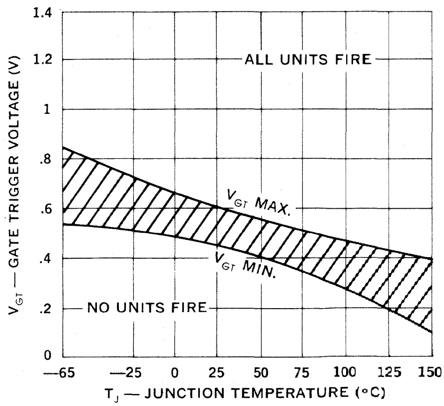


TYPICAL CHARACTERISTICS
2N3030 — 2N3031 — 2N3032

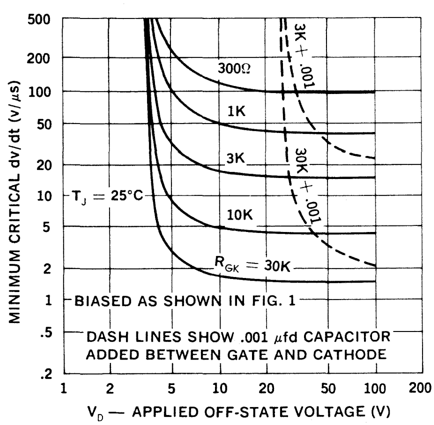
1 Gate Trigger Current



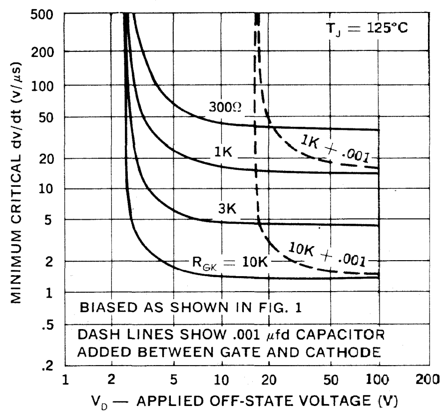
2 Gate Trigger Voltage



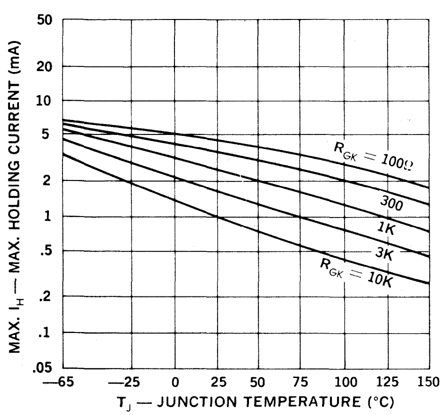
3 Min. Critical dv/dt (25°C — R Bias)



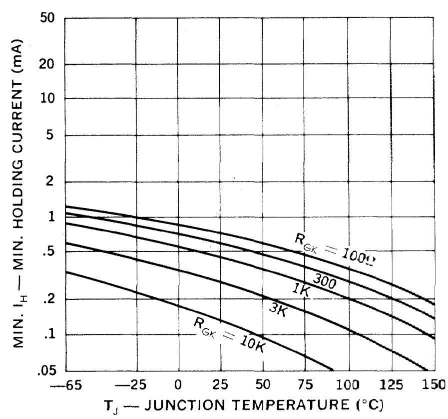
4 Min. Critical dv/dt (125°C — R Bias)



5 Max. Holding Current (Resistor Bias)

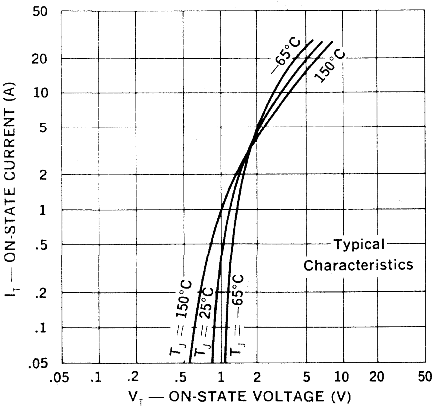


6 Min. Holding Current (Resistor Bias)

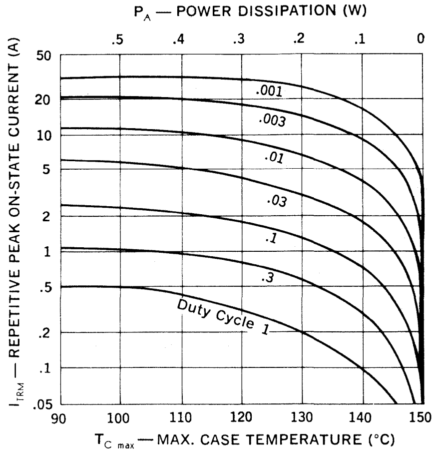


CURRENT RATINGS

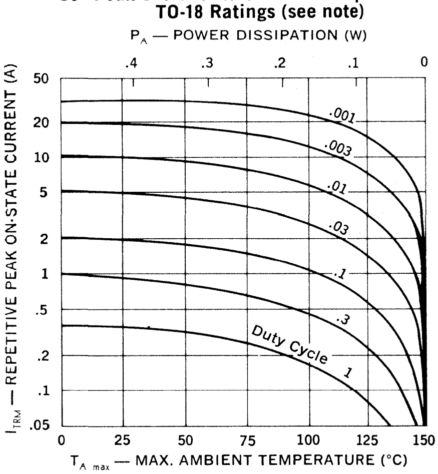
C1 Forward on Current vs. Voltage



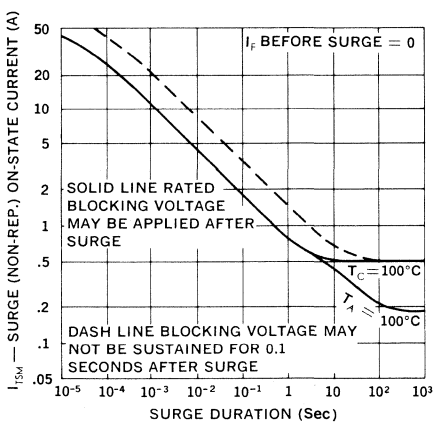
C2 Peak Current vs. Case Temperature



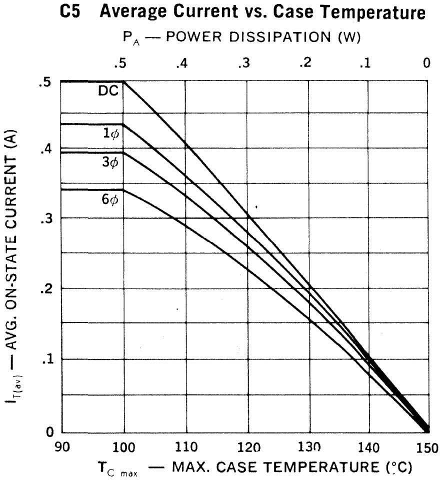
C3 Peak Current vs. Ambient Temperature TO-18 Ratings (see note)



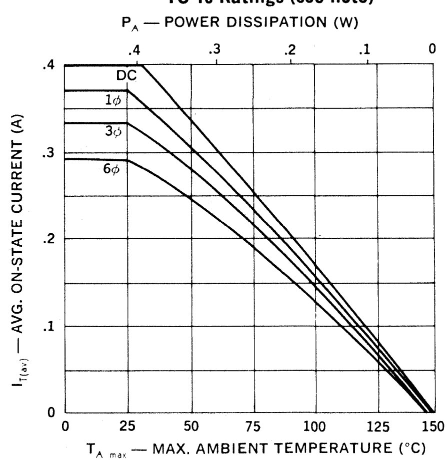
C4 Surge Current vs. Time



C5 Average Current vs. Case Temperature

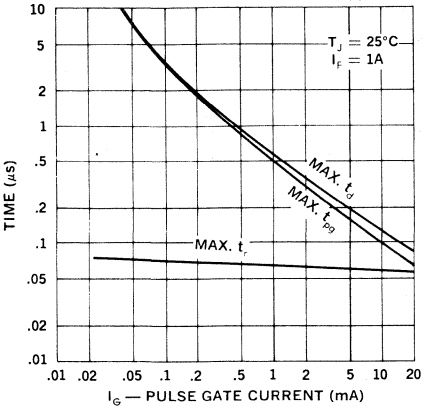


C6 Average Current vs. Ambient Temperature TO-18 Ratings (see note)

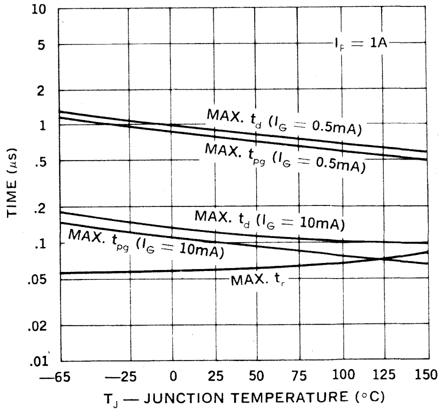


SWITCHING SPEEDS

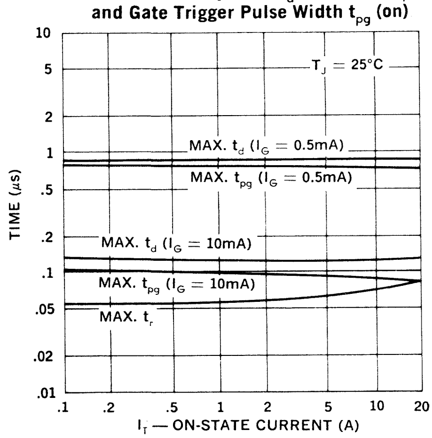
S1 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



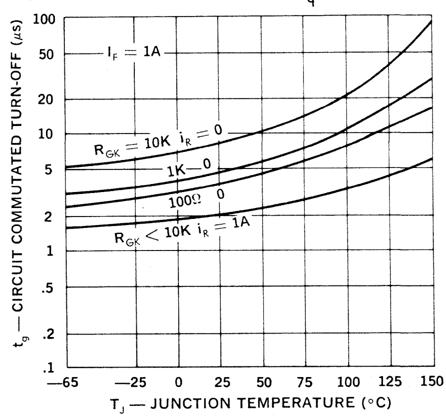
S2 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



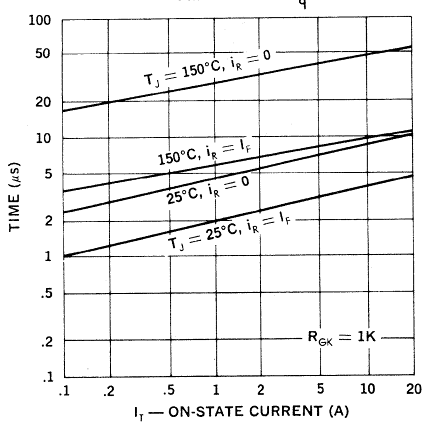
S3 Maximum Delay Time t_d, Rise Time t_r, and Gate Trigger Pulse Width t_{pg} (on)



S4 Maximum Circuit Commutated Turn-off Time t_q



S5 Maximum Circuit Commutated Turn-off Time t_q



POWER TRANSISTORS
3 Amp, 80V, Planar NPN

JAN, JANTX, & JANTXV 2N3418
JAN, JANTX, & JANTXV 2N3419
JAN, JANTX, & JANTXV 2N3420
JAN, JANTX, & JANTXV 2N3421

FEATURES
- Meets MIL-S-19500/393
- Collector-Base Voltage: up to 125V
- Peak Collector Current: 5A
- High Power Dissipation in TO-5: 15W @ $T_C = 100°C$
- Fast Switching

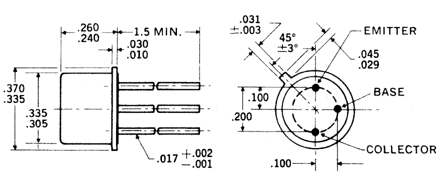
DESCRIPTION
Unitrode power transistors provide a unique combination of low saturation voltage, high gain, and fast switching. They are ideally suited for power supply, pulse amplifier and similar high frequency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN, JANTX, & JANTXV 2N3418 2N3420	JAN, JANTX, & JANTXV 2N3419 2N3421
Collector-Base Voltage, V_{CBO}	85V	125V
Collector-Emitter Voltage, V_{CEO}	60V	80V
Emitter-Base Voltage, V_{EBO}	8V	8V
D.C. Collector Current, I_C	3A	3A
Peak Collector Current, I_C	5A	5A
Power Dissipation		
25°C Ambient	1.0W	1.0W
100°C Case	15W	15W
Operating and Storage Temperature Range	−65°C to +200°C	

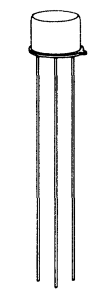
MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 2N3418-2N3421



Dimensions in inches.

TO-5



UNITRODE

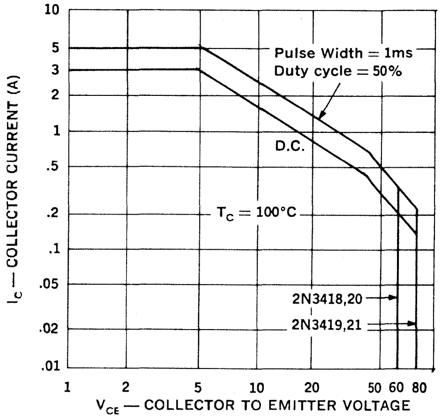
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

TEST	SYMBOL	MIN.	MAX.	UNITS	/393 Sub-group	MIL-STD-750 METHOD	MIL-STD-750 TEST CONDITIONS
Visual and Mechanical	—	—	—	—	A-1	2071	See Mechanical Data
Collector-Emitter Breakdown Voltage (1.)	BV_{CEO}				A-2	3011	$I_C = 50mAdc$, Cond. D
2N3418, 2N3420		60	—	Vdc			
2N3419, 2N3421		80	—	Vdc			
Collector-Emitter Cutoff Current	I_{CEX}				A-2	3041	$V_{EB} = 0.5Vdc$, Cond. A
2N3418, 2N3420		—	0.5	μAdc			$V_{CE} = 80Vdc$
2N3419, 2N3421		—	0.5	μAdc			$V_{CE} = 120Vdc$
Collector-Emitter Cutoff Current	I_{CEO}				A-2	3041	Cond. D
2N3418, 2N3420		—	5.0	μAdc			$V_{CE} = 45Vdc$
2N3419, 2N3421		—	5.0	μAdc			$V_{CE} = 60Vdc$
Emitter-Base Cutoff Current	I_{EBO}	—	0.5	μAdc	A-2	3061	$V_{EB} = 6Vdc$, Cond. D
Emitter-Base Cutoff Current	I_{EBO}	—	10	μAdc	A-2	3061	$V_{EB} = 8Vdc$, Cond. D
D.C. Current Gain (1.)	h_{FE}				A-3	3076	$I_C = 100mAdc$, $V_{CE} = 2Vdc$
2N3418, 2N3419		20	—	—			
2N3420, 2N3421		40	—	—			
D.C. Current Gain (1.)	h_{FE}				A-3	3076	$I_C = 1Adc$, $V_{CE} = 2Vdc$
2N3418, 2N3419		20	60	—			
2N3420, 2N3421		40	120	—			
D.C. Current Gain (1.)	h_{FE}				A-3	3076	$I_C = 2Adc$, $V_{CE} = 2Vdc$
2N3418, 2N3419		15	—	—			
2N3420, 2N3421		30	—	—			
D.C. Current Gain (1.)	h_{FE}				A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
2N3418, 2N3419		10	—	—			
2N3420, 2N3421		15	—	—			
Collector-Emitter Saturation Voltage (1.)	$V_{CE(sat)}$	—	0.25	Vdc	A-3	3071	$I_C = 1Adc$, $I_B = 0.1Adc$
Collector-Emitter Saturation Voltage (1.)	$V_{CE(sat)}$	—	0.5	Vdc	A-3	3071	$I_C = 2Adc$, $I_B = 0.2Adc$
Base-Emitter Saturation Voltage (1.)	$V_{BE(sat)}$	0.6	1.2	Vdc	A-3	3066	$I_C = 1Adc$, $I_B = 0.1Adc$
Base-Emitter Saturation Voltage (1.)	$V_{BE(sat)}$	0.7	1.4	Vdc	A-3	3066	$I_C = 2Adc$, $I_B = 0.2Adc$
Gain Bandwidth Product	f_T	40	160	MHz	A-4	3306	$I_C = 0.1Adc$, $V_{CE} = 10Vdc$, $f = 20MHz$
Output Capacitance	C_{ob}	—	150	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Switching Parameters							
Turn-on Time	t_{on}	—	0.3	μS	A-4	—	$I_C = 1Adc$, $I_{B1} = -I_{B2} = 0.1Adc$
Turn-off Time	t_{off}	—	1.2	μS	A-4	—	See Switching Speed Circuit
100°C							
Forward Biased Second Breakdown	$I_{S/b}$	3	—	Adc	B-6	3005	$V_{CE} = 5Vdc$, $t = 60sec$, $T_C = 100°C$
Forward Biased Second Breakdown	$I_{S/b}$	1	—	Adc	B-6	3005	$V_{CE} = 15Vdc$, $t = 60sec$, $T_C = 100°C$
Forward Biased Second Breakdown	$I_{S/b}$	0.4	—	Adc	B-6	3005	$V_{CE} = 37Vdc$, $t = 60sec$, $T_C = 100°C$
Forward Biased Second Breakdown	$I_{S/b}$				B-6	3005	$t = 60sec$, $T_C = 100°C$
2N3418, 2N3420		185	—	mAdc			$V_{CE} = 60Vdc$
2N3419, 2N3421		120	—	mAdc			$V_{CE} = 80Vdc$
Unclamped Reverse Biased Second Breakdown	$E_{S/b}$	45	—	mj	B-7	—	$I_C = 3Adc$, $L = 10mH$, Base Open
Clamped Reverse Biased Second Breakdown	$E_{S/b}$	180	—	mj	B-8	—	$I_C = 3Adc$, $L = 40mH$, V clamp = Rated V_{CBO}
150°C							
Collector-Emitter Cutoff Current	I_{CEX}				A-5	3041	$V_{EB} = 0.5Vdc$, Cond. A, $T_A = 150°C$
2N3418, 2N3420		—	50	μAdc			$V_{CE} = 80Vdc$,
2N3419, 2N3421		—	50	μAdc			$V_{CE} = 120Vdc$,
−55°C							
D.C. Current Gain (1.)	h_{FE}	10	—	—	A-5	3076	$I_C = 1Adc$, $V_{CE} = 2Vdc$, $T_A = -55°C$

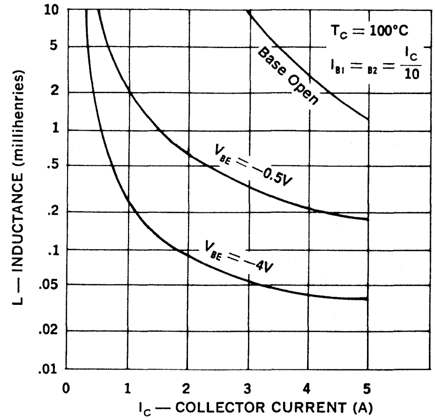
Note: 1. Pulse width = 300μSec, duty cycle ⩽ 2%.

UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

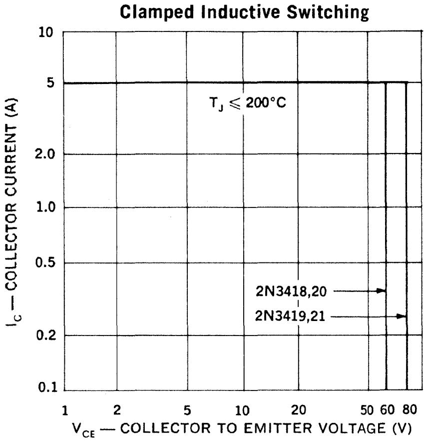
Forward Bias Safe Operating Area



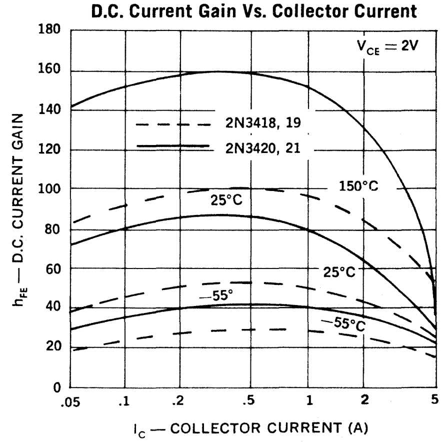
Unclamped Reverse Bias Second Breakdown



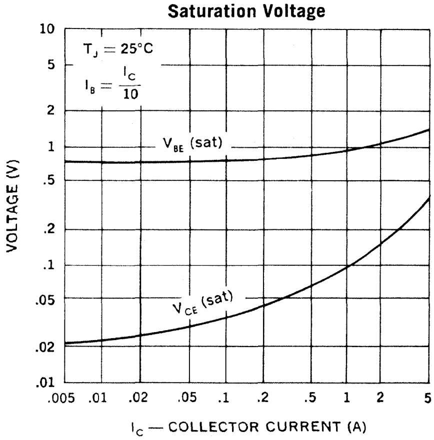
Reverse Bias Safe Operating Area Clamped Inductive Switching



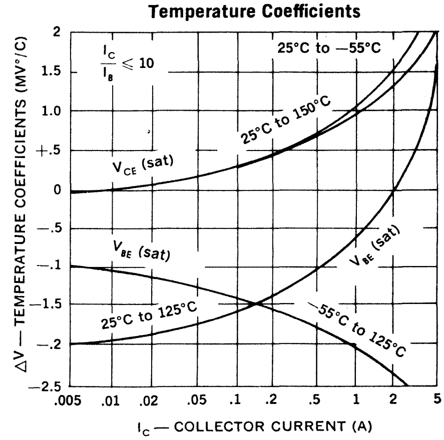
D.C. Current Gain Vs. Collector Current



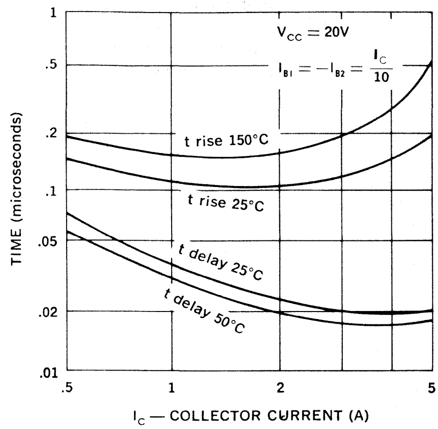
Saturation Voltage



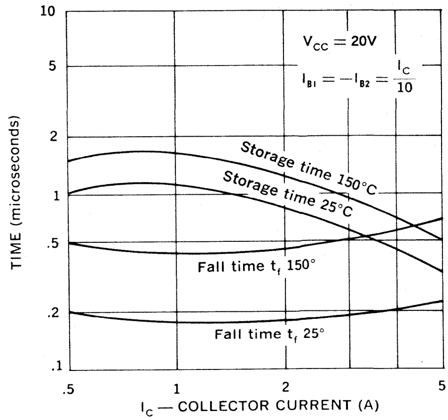
Saturation Voltage Temperature Coefficients



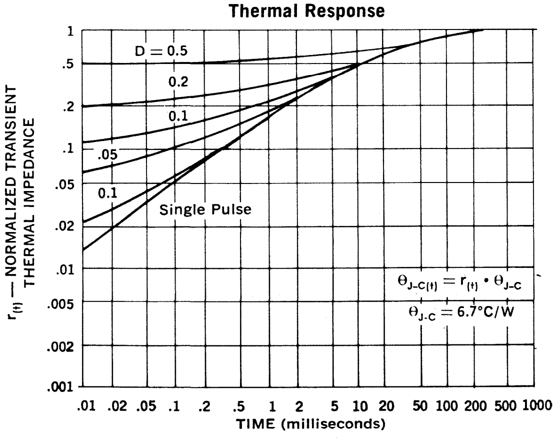
Switching Speed Characteristics



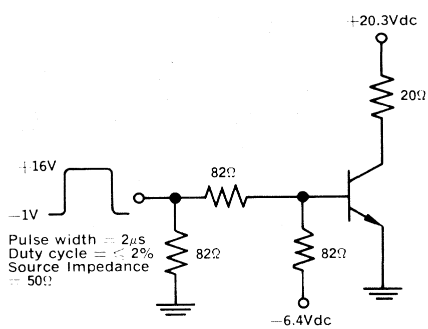
Switching Speed Characteristics



Thermal Response



Switching Speed Circuit



POWER TRANSISTORS
5 Amp, 80V, Planar NPN

JAN, JANTX, & JANTXV 2N3996
JAN, JANTX, & JANTXV 2N3997
JAN, JANTX, & JANTXV 2N3998
JAN, JANTX, & JANTXV 2N3999

FEATURES
- Meets MIL-S-19500/374*
- Collector-Base Voltage: Up to 100V
- D.C. Collector Current: 5A
- Fast Switching
- Beta Guaranteed at 3 Current Levels

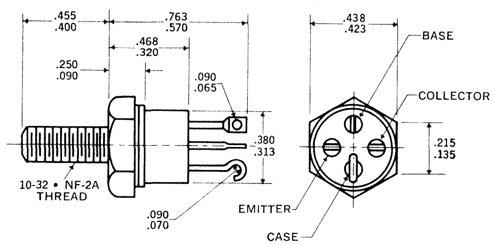
DESCRIPTION
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN, JANTX, & JANTXV 2N3996 JAN, JANTX, & JANTXV 2N3997 JAN, JANTX, & JANTXV 2N3998 JAN, JANTX, & JANTXV 2N3999
Collector-Base Voltage, V_{CBO}	100V
Collector-Emitter Voltage, V_{CER}	80V
Emitter-Base Voltage, V_{EBO}	8V
D.C. Collector Current, I_C	5V
Power Dissipation	
25°C Ambient	2W
100°C Case	30W
Operating and Storage Temperature Range	—65°C to 200°C

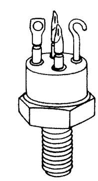
MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 2N3996, 2N3997

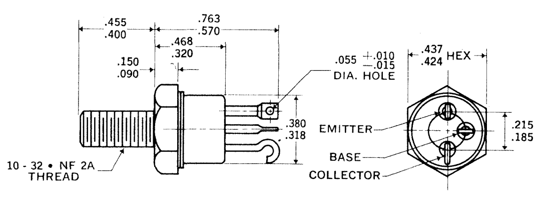


Dimensions in inches.

TO-111

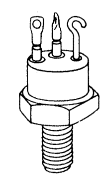


JAN, JANTX, & JANTXV 2N3998, 2N3999



Dimensions in inches.

TO-59



UNITRODE

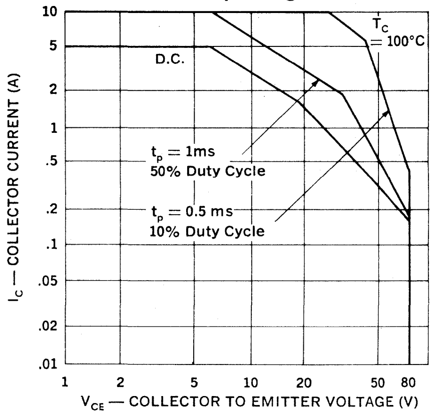
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	2N3996* 2N3998* Min.	Max.	2N3997* 2N3999* Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	30	—	60	—	—	I_C=50 mA, V_{CE}=2V
D.C. Current Gain (Note 1)	h_{FE}	40	120	80	240	—	I_C=1A, V_{CE}=2V
D.C. Current Gain (Note 1)	h_{FE}	15	—	20	—	—	I_C=5A, V_{CE}=5V
D.C. Current Gain, —55°C (Note 1)	h_{FE}	10	—	20	—	—	I_C=1A, V_{CE}=2V
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	0.25	—	0.25	V	I_C=1A, I_B=100 mA
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	2	—	2	V	I_C=5A, I_B=500 mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)	0.6	1.2	0.6	1.2	V	I_C=1A, I_B=100 mA
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.6	—	1.6	V	I_C=5A, I_B=500 mA
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	80	—	80	—	V	I_C=50 mA, I_B=0
Emitter-Base Cutoff Current	I_{EBO}	—	0.5	—	0.5	μA	V_{BE}=5V, I_C=0
Emitter-Base Cutoff Current	I_{EBO}	—	10	—	10	μA	V_{BE}=8V, I_C=0
Collector Cutoff Current	I_{CES}	—	5	—	5	μA	V_{CE}=90V, R_{BE}=0
Collector Cutoff Current	I_{CEO}	—	10	—	10	μA	V_{CE}=60V, I_B=0
Collector Cutoff Current, 150°C	I_{CES}	—	50	—	50	μA	V_{CE}=90, R_{BE}=0
Collector Capacitance	C_{ob}	—	150	—	150	pf	V_{CB}=10V, I_E=0, f=1 MHz
A.C. Current Gain (High Frequency)	h_{fe}	4	—	4	—	—	I_C=1A, V_{CE}=5V, f=10 MHz
Switching Speeds Turn-on Time	t_{on}	—	0.3	—	0.3	μs	I_C=1A
Switching Speeds Turn-off Time	t_{off}	—	1.5	—	2	μs	I_{b1}=100mA, I_{b2}= —100 mA

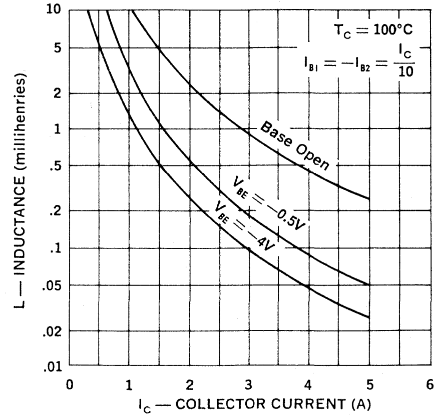
Notes:
1. Pulse Length=300μs; duty cycle ≤2%
† All Values in This Table are JEDEC Registered

*Also applicable to JAN and JANTX versions

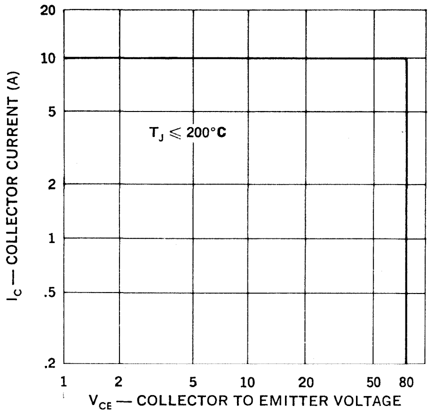
Forward Bias Safe Operating Area



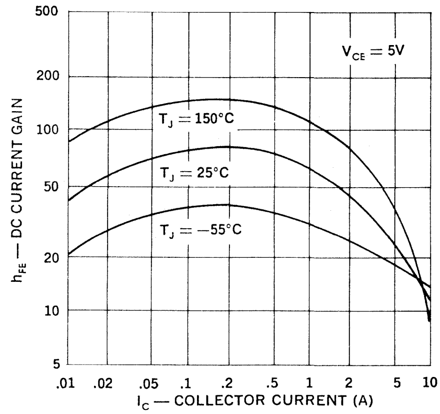
Unclamped Reverse Bias Second Breakdown



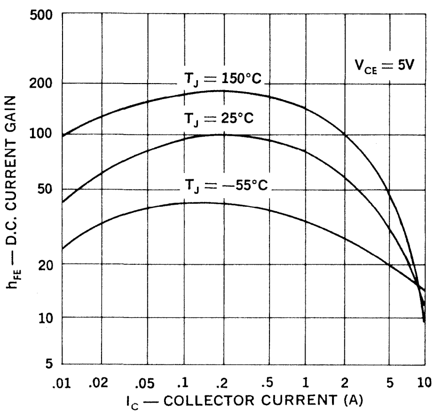
Reverse Bias Safe Operating Area Clamped Inductive Switching



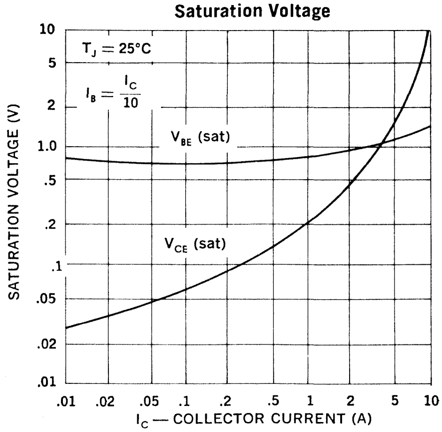
D.C. Current Gain 2N3996-2N3998



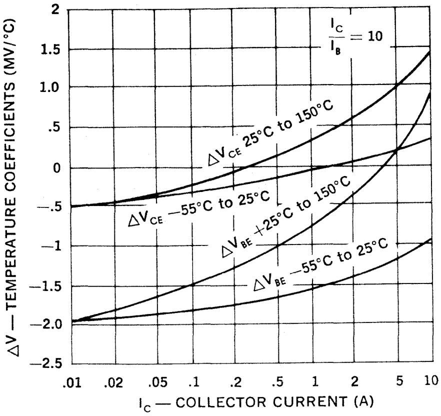
D.C. Current Gain 2N3997-2N3999



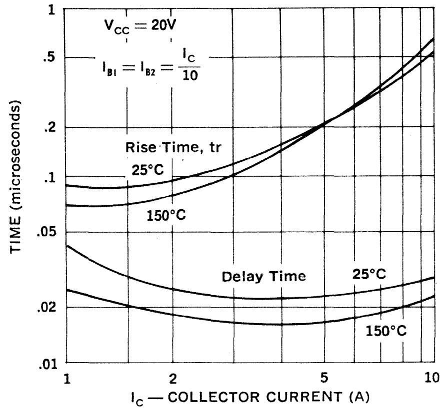
Saturation Voltage



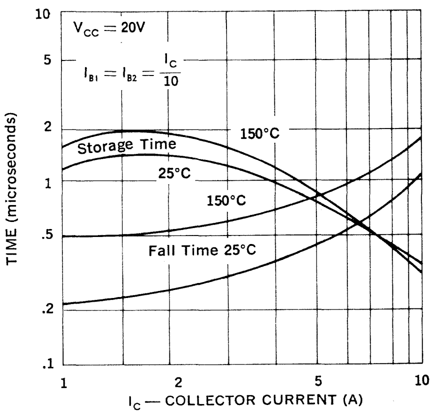
Saturation Voltage Temperature Coefficients



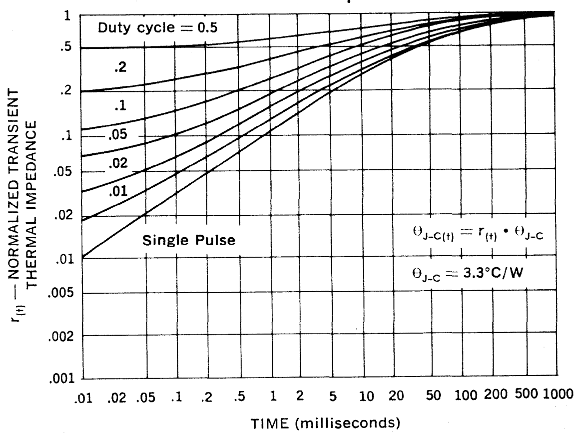
Switching Speed Characteristics



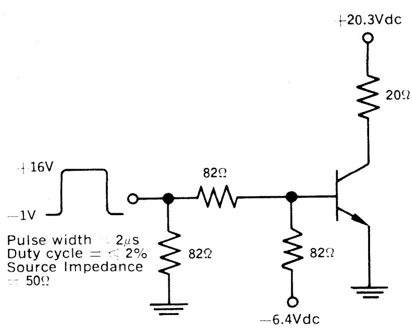
Switching Speed Characteristics



Thermal Response



Switching Speed Circuit



NOTES:

1. $I_C \approx 1A$, $I_{B1} \approx -I_{B2} \approx 100mA$
2. The values of collector current and base current are nominal. The actual values will vary slightly with transistor parameters.

POWER TRANSISTORS

10 Amp, 70V, Planar NPN

JAN & JANTX 2N4150

FEATURES

- Meets MIL-S-19500/394
- Collector-Base Voltage: up to 100V
- Peak Collector Current: 10A
- Fast Switching
- Low Saturation Voltage

DESCRIPTION

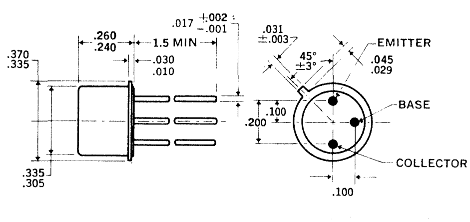
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	JAN & JANTX 2N4150
Collector-Base Voltage, V_{CBO}	100V
Collector-Emitter Voltage, V_{CER}	70V
Emitter-Base Voltage, V_{EBO}	5V
Peak Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.5W
100°C Case	5W
Operating and Storage Temperature Range	—65°C to 200°C

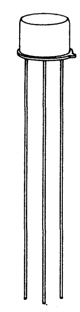
MECHANICAL SPECIFICATIONS

JAN & JANTX 2N4150



Dimensions in inches.

TO-5



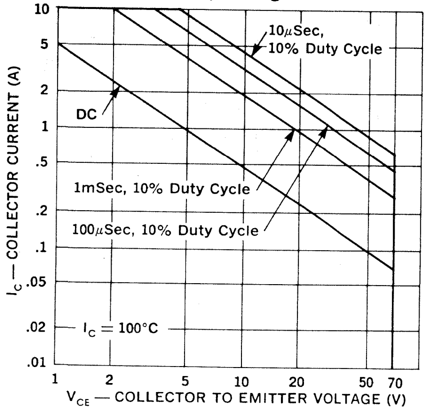
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

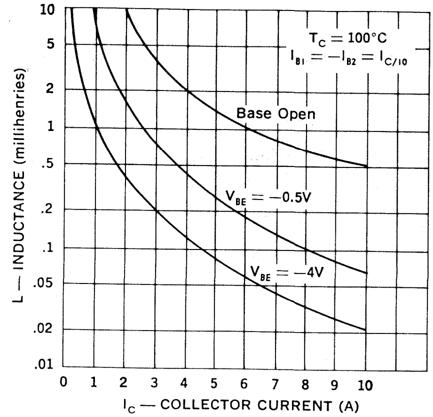
Test		Symbol	Min.	Max.	Units	/394 Sub group	Method	MIL-STD-750 Test conditions
Visual and Mechanical						A-1	2071	See Mechanical Data
25°C								
Collector-Base Breakdown Voltage		BV_{CBO}	100	—	Vdc	A-2	3001	$I_C = 10uAdc$; Cond. D
Collector-Emitter Breakdown Voltage (Note 1)		BV_{CEO}	70	—	Vdc	A-2	3011	$I_C = 0.1Adc$; Cond. D
Emitter-Base Breakdown Voltage		BV_{EBO}	7	—	Vdc	A-2	3026	$I_E = 10uAdc$; Cond. D
Collector-Emitter Cutoff Current		I_{CEO}	—	10	μAdc	A-2	3041	$V_{CE} = 60Vdc$; Cond. D
Collector-Emitter Cutoff Current		I_{CEX}	—	10	μAdc	A-2	3041	$V_{CE} = 100Vdc$, $V_{EB} = 0.5Vdc$; Cond. A
Collector-Base Cutoff Current		I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 80Vdc$; Cond. D
Emitter-Base Cutoff Current		I_{EBO}	—	0.1	μAdc	A-2	3061	$V_{EB} = 5Vdc$; Cond. D
D.C. Current Gain (Note 1)		h_{FE}	40	120	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	10	—	—	A-3	3076	$I_C = 10Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	50	—	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)		V_{CE} (sat)	—	0.6	Vdc	A-4	3071	$I_C = 5Adc$, $I_B = 0.5Adc$
Collector Saturation Voltage (Note 1)		V_{CE} (sat)	—	2.5	Vdc	A-4	3071	$I_C = 10Adc$, $I_B = 1Adc$
Base Saturation Voltage (Note 1)		V_{BE} (sat)	—	1.5	Vdc	A-4	3066	$I_C = 5Adc$, $I_B = 0.5Adc$; Cond. A
Base Saturation Voltage (Note 1)		V_{BE} (sat)	—	2.5	Vdc	A-4	3066	$I_C = 10Adc$, $I_B = 1Adc$; Cond. A
A.C. Current Gain		h_{fe}	40	160	—	A-4	3206	$I_C = 50mAdc$, $V_{CE} = 5Vdc$, f = 1KHz
Gain-Bandwidth Product		f_T	15	75	MHz	A-4	3306	$I_C = 0.2Adc$, $V_{CE} = 10Vdc$, f = 10 MHz
Output Capacitance		C_{ob}	—	350	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Thermal Resistance		θ_{J-C}	—	20	°C/W	C-1	3151	
Switching Speeds	Delay Time	t_d	—	50	ns	A-4	—	$V_{CC} = 20V$
	Rise Time	t_r	—	500	ns	A-4	—	$I_C = 5A$
	Storage Time	t_s	—	1.5	μs	A-4	—	$I_{B1} = I_{B2}$, $I_{B1} = 0.5A$
	Fall Time	t_f	—	500	ns	A-4	—	
100°C								
Forward-Biased Second Breakdown		$I_{S/B}$	5	—	Adc	B-6	3005	V_{CE} — 1Vdc, t = 60Sec,
Forward-Biased Second Breakdown		$I_{S/B}$	70	—	mAdc	B-6	3005	V_{CE} — 70Vdc, t = 60Sec,
Unclamped Reverse Biased Second Breakdown		$E_{S/B}$	12.5	—	mj	B-7	—	$I_C = 5Adc$, L = 1mh
Clamped Reverse Biased Second Breakdown		$E_{S/B}$	200	—	mj	B-8	—	$I_C = 5Adc$, L = 40mh, $V_{clamp} = 70V$
150°C								
Collector-Emitter Cutoff Current		I_{CEX}	—	100	μAdc	A-5	3041	$V_{CE} = 80Vdc$, $V_{EB} = 0.5Vdc$, Cond. A
−55°C								
D.C. Current Gain (Note 1)		h_{FE}	20	—	—	A-5	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$

Note: 1. Pulse length = 300μs; duty cycle ≤2%.

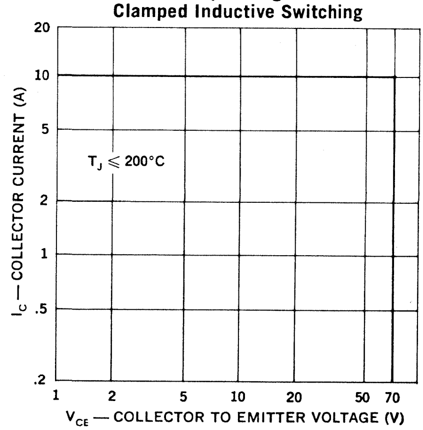
Forward Bias Safe Operating Area



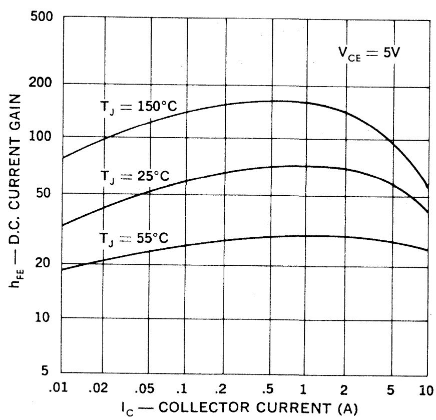
Unclamped Reverse Bias Second Breakdown



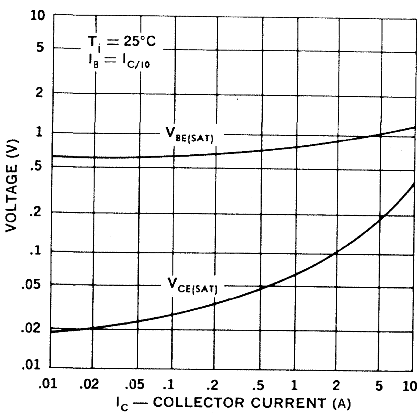
Reverse Bias Safe Operating Area Clamped Inductive Switching



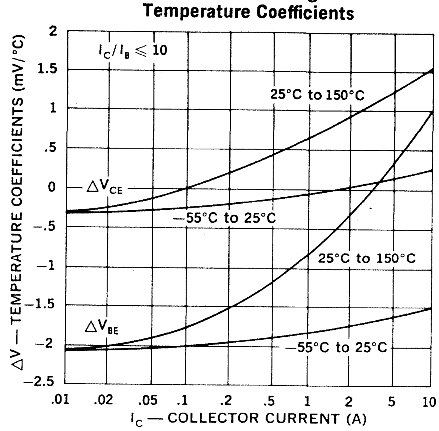
D.C. Current Gain



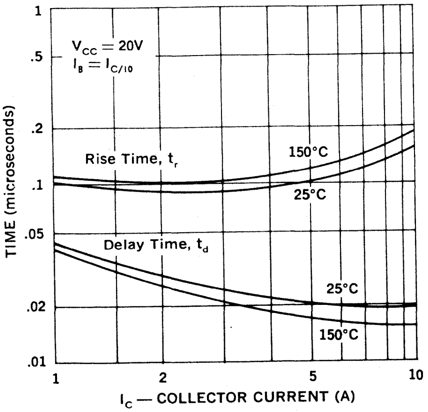
Saturation Voltages



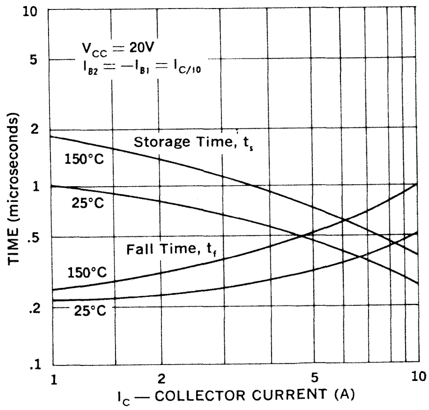
Saturation Voltage Temperature Coefficients



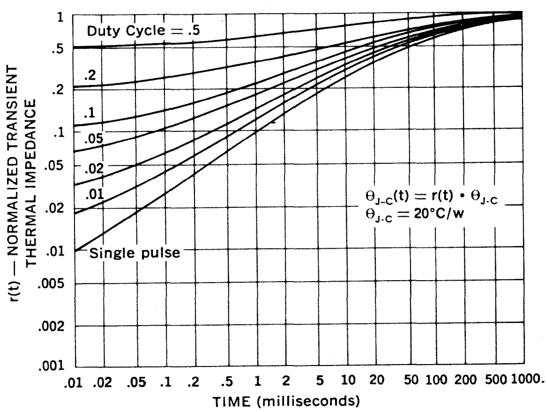
Switching Speed Characteristics



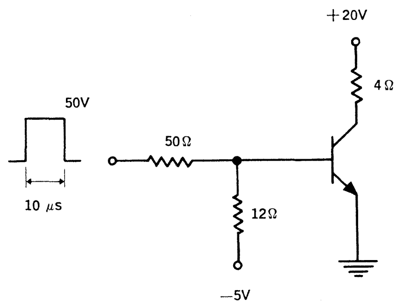
Switching Speed Characteristics



Thermal Response



Switching Speed Circuit



$I_C = 5A, I_{B1} = -I_{B2} = .5A$

POWER TRANSISTORS

20 Amp, 150 V, Double Diffused NPN Mesa

2N5038
2N5039
2N6354
2N6496

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 30A
- Rise Time: ≤ 500ns } @ I_C up to 12A
- Fall Time: ≤ 500ns } @ I_C up to 12A

DESCRIPTION

These double diffused glass passivated mesa power transistors combine fast-switching, low saturation voltage and rugged $E_{S/b}$ capability. They are designed for use in switching regulators, converters, inverters and switching-control amplifiers.

ABSOLUTE MAXIMUM RATINGS*

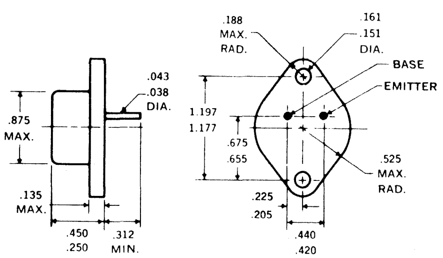
	2N5038	2N5039	2N6354	2N6496
Collector-Base Voltage, V_{CBO}	150V	120V	150V	150V
Collector-Emitter Sustaining Voltage, $V_{CER\ (SUS)}$ (1)	110V	95V	—	130V
$V_{CEO\ (SUS)}$	90V	75V	120V	110V
Emitter-Base Voltage, V_{EBO}	7V	7V	6.5V	7V
Collector Current, I_C continuous	20A	20A	10A	15A
Collector Current, I_{CM} peak	30A	30A	12A	—
Base Current, I_B continuous	5A	5A	5A	5A
Power Dissipation, 25°C Case	140W	140W	140W	140W
Operating and Storage Temperature Range	−65 to 200°C			

(1) With $R_{BE} \leq 50\Omega$

* JEDEC registered values.

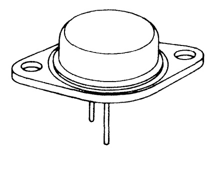
MECHANICAL SPECIFICATIONS

2N5038, 2N5039, 2N6354, 2N6496



Dimensions in inches.

TO-3



UNITRODE

Electrical Specifications (at 25°C unless noted)

	Test	Symbol	2N5038		2N5039		2N6354		2N6496		Units	Test Conditions
			MIN.	MAX.	MIN.	MAX.	MIN.	MAX.	MIN.	MAX.		
*	D.C. Current Gain (Note 1)	h_{FE}	50	250	30	250	—	—	—	—		$I_C = 2A$, $V_{CE} = 5V$
			—	—	—	—	20	150	—	—		$I_C = 5A$, $V_{CE} = 2V$
*	D.C. Current Gain (Note 1)	h_{FE}	—	—	—	—	—	—	12	100		$I_C = 8A$, $V_{CE} = 2V$
			—	—	—	—	10	100	—	—		$I_C = 10A$, $V_{CE} = 2V$
*	D.C. Current Gain (Note 1)	h_{FE}	—	—	20	100	—	—	—	—		$I_C = 10A$, $V_{CE} = 5V$
			20	100	—	—	—	—	—	—		$I_C = 12A$, $V_{CE} = 5V$
*	Collector Saturation Voltage (Note 1)	$V_{CE\ (sat)}$	—	—	—	—	—	0.5	—	—	V	$I_C = 5A$, $I_B = .5A$
			—	—	—	—	—	—	—	1.0		$I_C = 8A$, $I_B = .8A$
	Collector Saturation Voltage (Note 1)	$V_{CE\ (sat)}$	—	—	—	1.0	—	1.0	—	—	V	$I_C = 10A$, $I_B = 1.0A$
	Collector Saturation Voltage (Note 1)	$V_{CE\ (sat)}$	—	1.0	—	—	—	—	—	—	V	$I_C = 12A$, $I_B = 1.2A$
			—	2.5*	—	2.5*	—	—	—	—		$I_C = 20A$, $I_B = 5A$
	Base Saturation Voltage (Note 1)	$V_{BE\ (sat)}$	—	—	—	—	—	1.3*	—	—	V	$I_C = 5A$, $I_B = 0.5A$
			—	—	—	—	—	—	—	2.0		$I_C = 8A$, $I_B = 0.8A$
*	Base Saturation Voltage (Note 1)	$V_{BE\ (sat)}$	—	—	—	—	—	2.0	—	—	V	$I_C = 10A$, $I_B = 1A$
			—	3.3	—	3.3	—	—	—	—	V	$I_C = 20A$, $I_B = 5A$
	Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO\ (sus)}$	90	—	75	—	120	—	100	—	V	$I_C = 0.2A$
	Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEX\ (sus)}$	150	—	120	—	—	—	—	—	V	$I_C = 0.2A$, $V_{BE} = -1.5V$, $I_B = 0$, $R_{BE} = 100\ \Omega$
	Collector-Emitter Sustaining Voltage (Note 2)	$V_{CER\ (sus)}$	110	—	95	—	—	—	130	—	V	$R_{BE} = 50\ \Omega$, $I_C = 0.2A$
			—	—	—	—	130	—	—	—		$R_{BE} = 100\ \Omega$, $I_C = 0.2A$
*	Emitter-Base Voltage	V_{EBO}	—	—	—	—	6.5	—	—	—	V	$I_E = 5mA$
			7.0	—	7.0	—	—	—	7.0	—		$I_E = 50mA$
*	Collector Cutoff Current	I_{CBO}	—	—	—	—	—	5	—	—	mA	$V_{CB} = 150V$
	Collector Cutoff Current	I_{CEO}	—	—	—	20	—	—	—	—	V	$V_{CE} = 55V$
			—	20	—	—	—	—	—	—		$V_{CE} = 70V$
			—	—	—	—	—	20	—	—		$V_{CE} = 100V$
*	Collector Cutoff Current	I_{CEV}	—	—	—	—	—	—	—	—	mA	$V_{CE} = 110V$, $V_{BE} = -1.5V$
			—	—	—	50	—	—	—	20		$V_{CE} = 130V$, $V_{BE} = 0$
			—	50	—	—	—	—	—	—		$V_{CE} = 140V$, $V_{BE} = -1.5V$
			—	—	—	—	—	10	—	—		$V_{CE} = 140V$, $V_{BE} = 0$
*	Collector Cutoff Current, 125°C	I_{CEV}	—	—	—	—	—	20	—	—	mA	$V_{CE} = 140V$
*	Collector Cutoff Current, 150°C	I_{CEV}	—	—	—	10	—	—	—	—	mA	$V_{CE} = 85V$, $V_{BE} = -1.5V$
			—	10	—	—	—	—	—	—		$V_{CE} = 100V$, $V_{BE} = -1.5V$
			—	—	—	—	—	—	—	25		$V_{CE} = 130V$, $V_{BE} = 0V$
*	Emitter Cutoff Current	I_{EBO}	—	5.0	—	15	—	—	—	—	mA	$V_{BE} = -5V$
			—	—	—	—	—	5.0	—	—		$V_{BE} = -6.5V$
			—	50	—	50	—	—	—	50		$V_{BE} = -7V$
	Magnitude of Small Signal Forward — Current Transfer Ratio	$\|h_{fe}\|$	12	—	12	—	—	—	12	—		$V_{CE} = 10V$, $I_C = 2A$, f = 5 MHz
			—	—	—	—	8.0	—	—	—		$V_{CE} = 10V$, $I_C = 1A$, f = 10 MHz
	Collector Capacitance	C_{ob}	—	300	—	300	—	300	—	300	pF	$V_{CB} = 10V$, f = 1 MHz
	Thermal Resistance: Junction-to-Case	$R_{\Theta JC}$	—	1.25	—	1.25	—	—	—	1.25	°C/W	$V_{CE} = 10V$, $I_C = 10A$
			—	—	—	—	—	1.25	—	—		$V_{CE} = 20V$, $I_C = 1A$

Notes

1. Pulse length = 250 μs; duty cycle ≤1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤1%. Voltage clamped at maximum collector-emitter voltage.

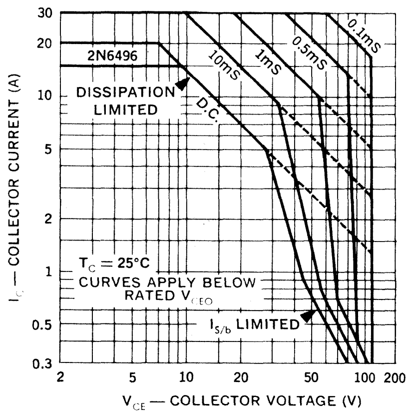
* JEDEC registered values.

Electrical Specifications (at 25°C unless noted)

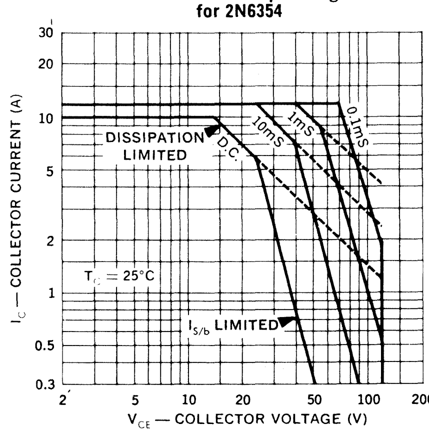
Test	Symbol	2N5038 MIN.	2N5038 MAX.	2N5039 MIN.	2N5039 MAX.	2N6354 MIN.	2N6354 MAX.	2N6496 MIN.	2N6496 MAX.	Units	Test Conditions
Second Breakdown Energy	$E_{S/b}$	—	—	—	—	0.3	—	—	—	mJ	$I_C = 5A$, $V_{BE} = -1.0V$, $R_{BE} = 51\ \Omega$, $L = 25\mu H$
		—	—	—	—	—	—	5.7	—		$I_C = 8A$, $V_{BE} = -4.0V$, $R_{BE} = 20\ \Omega$, $L = 180\mu H$
		13	—	13	—	—	—	—	—		$I_C = 13A$, $V_{BE} = -4.0V$, $R_{BE} = 20\ \Omega$, $L = 180\mu H$
Forward Bias Second Breakdown Collector Current	$I_{S/b}$	—	—	—	—	5.5	—	—	—	A	$V_{CE} = 25V$, t = 1s, non-rep.
		5.0	—	5.0	—	—	—	5.0	—		$V_{CE} = 28V$, t = 1s, non-rep.
		0.9	—	0.9	—	—	—	0.9	—		$V_{CE} = 45V$, t = 1s, non-rep.
* Switching Speeds											
Rise Time	t_r	—	—	—	—	—	0.3	—	—	μs	$I_C = 5A$
Storage Time	t_s	—	—	—	—	—	1.0	—	—		$I_{B1} = I_{B2} = .5A$
Fall Time	t_f	—	—	—	—	—	0.2	—	—		$V_{CC} = 30V$
Rise Time	t_r	—	—	—	—	—	—	—	0.5	μs	$I_C = 8A$
Storage Time	t_s	—	—	—	—	—	—	—	1.5		$I_{B1} = I_{B2} = .8A$
Fall Time	t_f	—	—	—	—	—	—	—	0.3		$V_{CC} = 30V$
Rise Time	t_r	—	—	—	0.5	—	—	—	—	μs	$I_C = 10A$
Storage Time	t_s	—	—	—	1.5	—	—	—	—		$I_{B1} = I_{B2} = 1.0A$
Fall Time	t_f	—	—	—	0.5	—	—	—	—		$V_{CC} = 30V$
Rise Time	t_r	—	0.5	—	—	—	—	—	—	μs	$I_C = 12A$
Storage Time	t_s	—	1.5	—	—	—	—	—	—		$I_{B1} = I_{B2} = 1.2A$
Fall Time	t_f	—	0.5	—	—	—	—	—	—		$V_{CC} = 30V$

* JEDEC registered values.

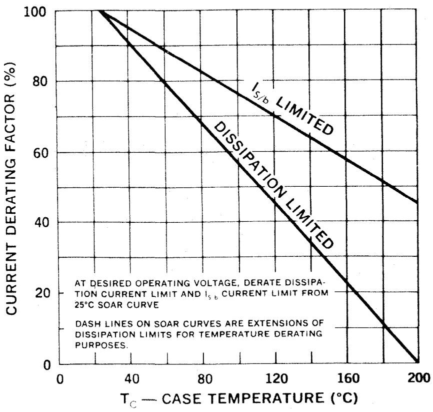
Forward Bias Safe Operating Area for 2N5038, 2N5039, and 2N6496



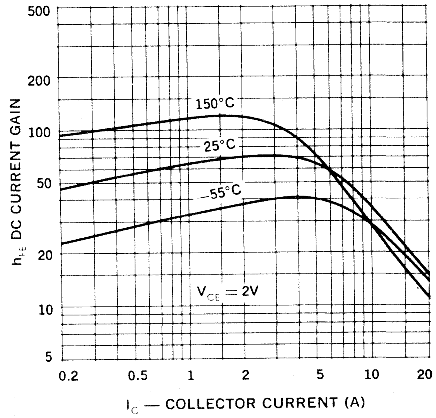
Forward Bias Safe Operating Area for 2N6354



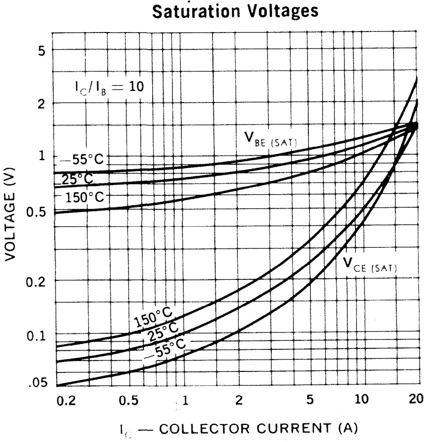
Power Derating



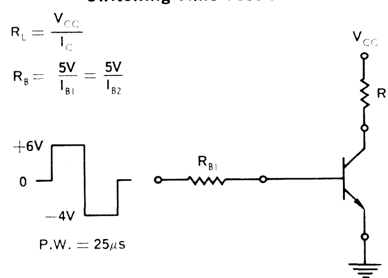
DC Current Gain



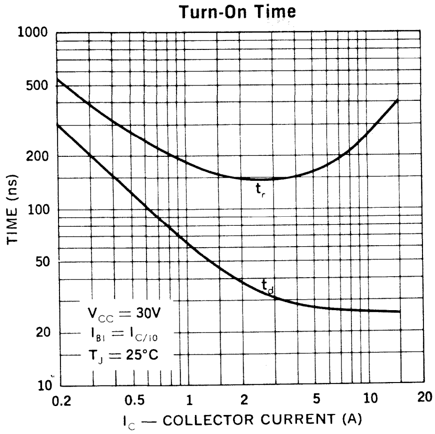
Saturation Voltages



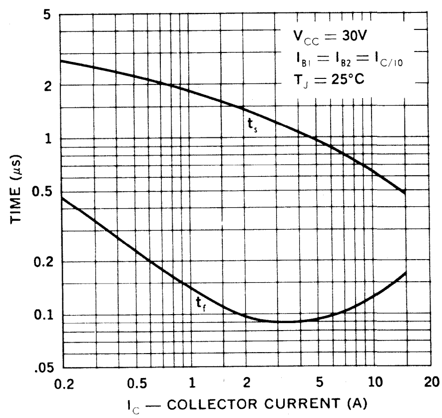
Switching Time Test Circuit



Turn-On Time



Turn-Off Time



SCRs

2N5060-2N5064

.8 Amp RMS, Plastic

FEATURES

- Voltage Ratings: to 200V
- Forward Current: 0.8A RMS
- Surge Current: 6A, 8ms
- Gate Sensitivity: 200μa max.
- Planar Passivated Process
- TO-92 Plastic Package

DESCRIPTION

This plastic series features very fast switching performance, low forward voltage drop and a high degree of reliability and parameter stability. All units are fully planar passivated and are packaged in a rugged TO-92 case, constructed from a special epoxy compound that features excellent moisture resistance providing stable performance under high humidity conditions and good thermal transfer characteristics.

TYPICAL APPLICATIONS

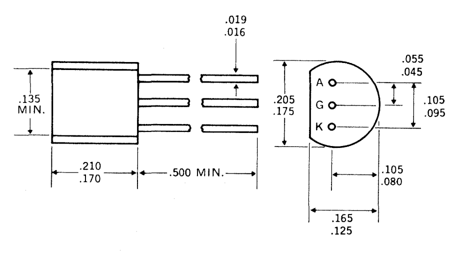
Lamp Driving	Process Controls	Remote Controls
Relay Driving	Pressure Controls	High Current SCR Driving
Relay Replacement	Display Systems	Timers
Alarm Systems	Touch Switches	Temperature Controls
Counters	and many other current sensing and control applications.	

ABSOLUTE MAXIMUM RATINGS

	2N5060	2N5061	2N5062	2N5063	2N5064
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V
On-State Current, $I_{T(RMS)}$			0.8A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			6A		
Peak Gate Current, I_{GM}			1.0A		
Peak Gate Power, P_{GM}			1W		
Average Gate Power $P_{G(AV)}$			0.01W		
Reverse Gate Voltage, V_{GR}			6V		
Storage Temperature Range			−65°C to +150°C		
Operating Temperature Range			−65°C to +125°C		

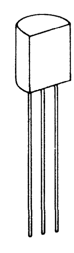
MECHANICAL SPECIFICATIONS

2N5060-2N5064



Dimensions in inches.

TO92



UNITRODE

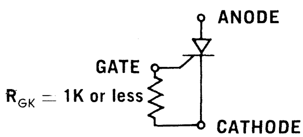
ELECTRICAL SPECIFICATIONS (at 25°C unless noted

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	0.1	1.0	μA	V_{DRM} = Rating $R_{GK} = 1K\Omega$
		—	—	50	μA	V_{DRM} = Rating, T = 125°C
Reverse Current	I_{RRM}	—	0.1	1.0	μA	V_{RRM} = Rating $R_{GK} = 1K\Omega$
		—	—	50	μA	V_{RRM} = Rating, T = 125°C
Gate Trigger Current	I_{GT}	—	—	200	μA	V_D = 7V, R_L = 100 ohms $R_{GS} = 10K\Omega$
		—	—	350	μA	V_D = 7V, R_L = 100 ohms, T = −65°C
Gate Trigger Voltage	V_{GT}	—	0.6	0.8	V	V_D = 7V, R_L = 100 ohms $R_{GS} = 10K\Omega$
		—	—	1.2	V	V_D = 7V, R_L = 100 ohms, T = −65°C
		0.1	—	—	V	V_D = Rating, R_L = 100 ohms, T = 125°C
Peak On-State Voltage	V_{TM}	—	1.2	1.7	V	I_{TM} = 1 Amp Pulse
Holding Current	I_H	—	0.7	5.0	mA	V_D = 7V, T = 25°C
		—	—	10.0	mA	V_D = 7V, T = −65°C
Critical Rate of Rise — Off-State Voltage	dv/dt	—	75	—	V/μs	V_D = Rated
Turn-on Time	t_{on}	—	0.1	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	8	—	μs	$I_T = I_R$ = 1A

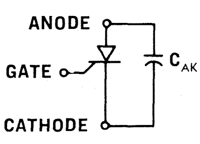
Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

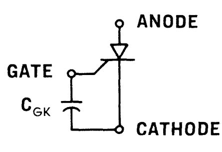
DESIGN CONSIDERATIONS

1. The 2N5060 Series SCRs are guaranteed to block their rated voltage over the rated operating temperature when a resistance of 1000 ohms or less is connected from gate to cathode as shown.

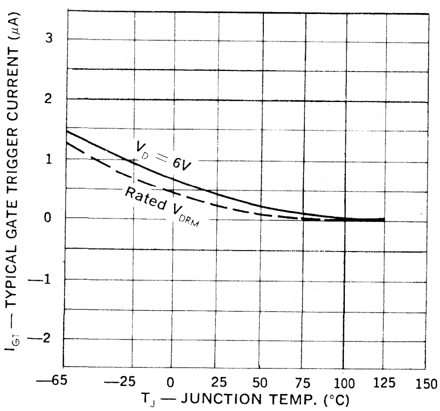


2. In cases where the SCR may be subjected to fast rising anode voltages a capacitor can be connected between anode or gate and cathode as shown, to serve as protection against dv/dt firing.

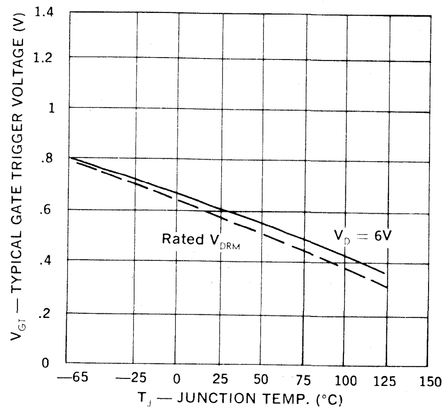




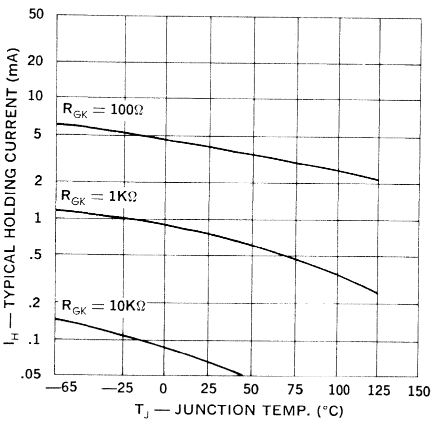
Gate Trigger Current vs. Junction Temp.



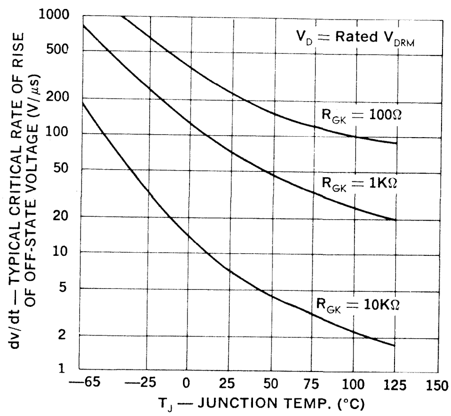
Gate Trigger Voltage vs. Junction Temp.



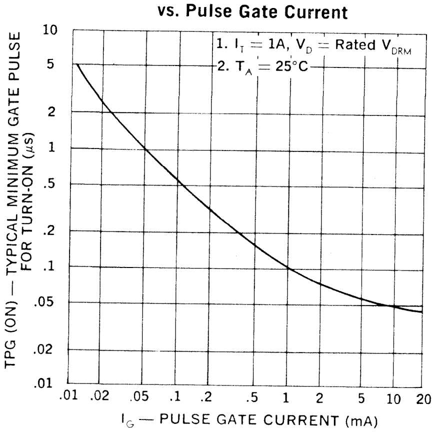
Holding Current vs. Junction Temp.



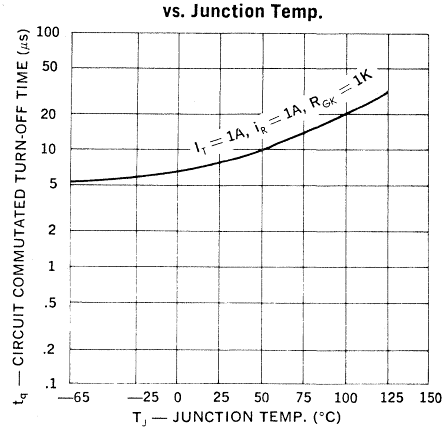
dv/dt vs. Junction Temp.



Gate Pulse For Turn-On vs. Pulse Gate Current



Forward Blocking Recovery Time vs. Junction Temp.



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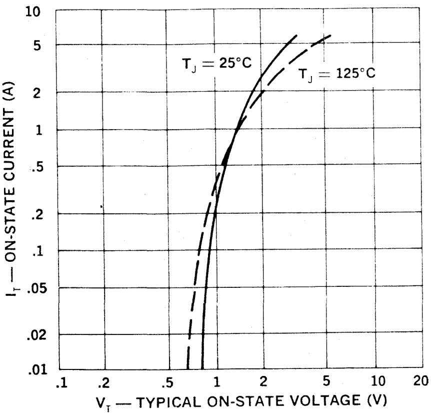
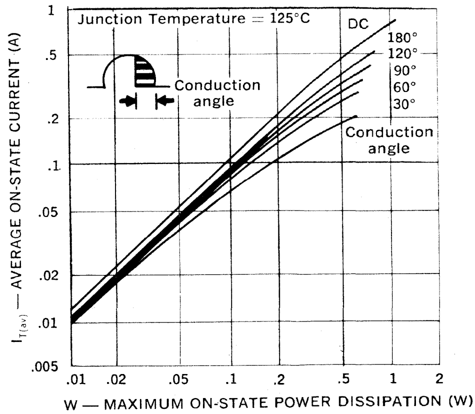
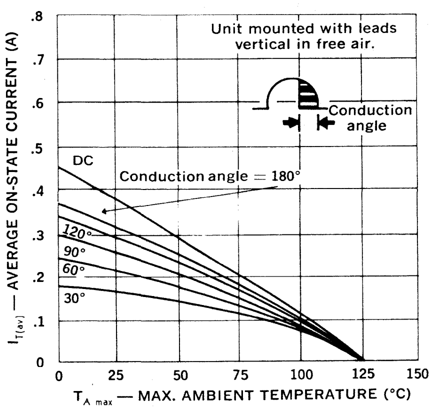
Current vs. On-State Voltage



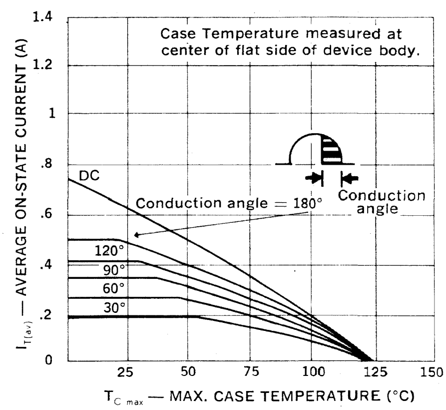
Current vs. Power Dissipation



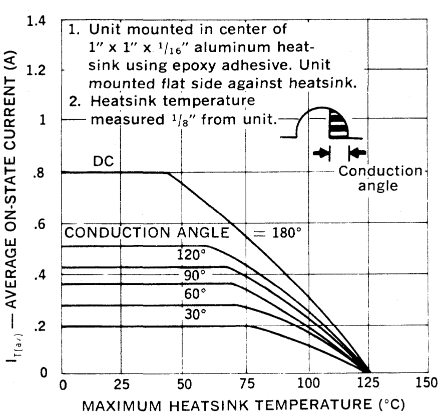
Current vs. Ambient Temp.



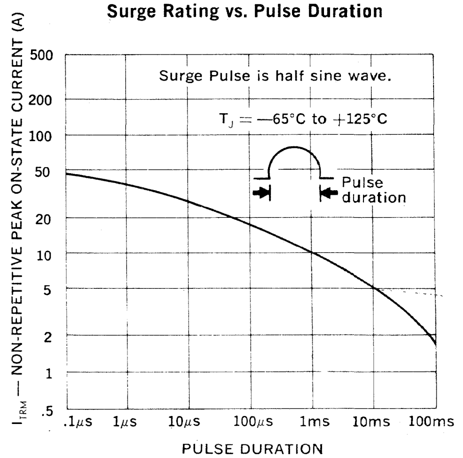
Current vs. Case Temp.



Current vs. Heatsink Temp.



Surge Rating vs. Pulse Duration



POWER TRANSISTORS
5 Amp, 150V, Planar NPN

2N5487 5487-1
2N5488 5487-3
5488-1
5488-3

FEATURES

- Collector-Base Voltage: up to 150V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching
- Low Saturation Voltage
- High Gain

DESCRIPTION

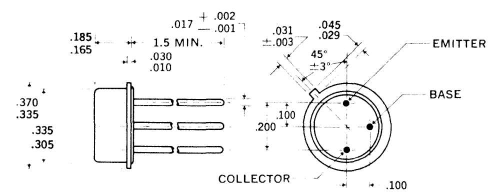
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5487 5487-1 5487-3	2N5488 5488-1 5488-3
Collector-Base Voltage, V_{CBO}	120V	150V
Collector-Emitter Voltage, V_{CER}	120V	150V
Emitter-Base Voltage, V_{EBO}	8V	8V
D.C. Collector Current, I_C	5A	10A
Peak Collector Current, I_C	10A	10A
Power Dissipation		
25°C Ambient	1.25W	1.25W
100°C Case	15W	15W
Operating and Storage Temperature Range	−65°C to 200°C	

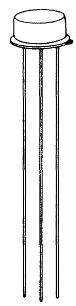
MECHANICAL SPECIFICATIONS

2N5487 2N5488

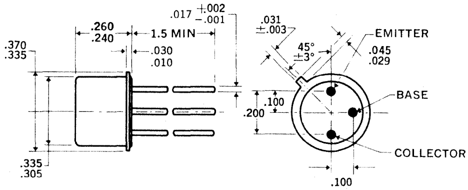


Dimensions in inches.

Pancake TO-5

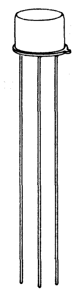


5487-1 5488-1



Dimensions in inches.

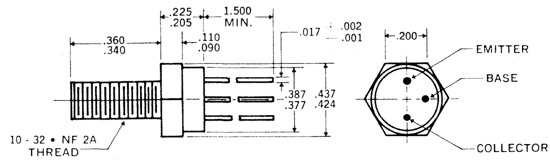
TO-5



UNITRODE

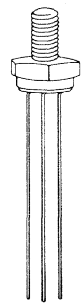
MECHANICAL SPECIFICATIONS

5487-3 5488-3



Dimensions in inches.

Low Profile
7/16 Hex



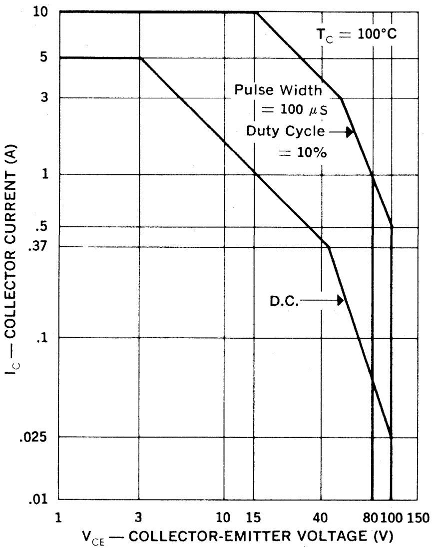
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	2N5487 Min.	2N5487 Max.	2N5488 Min.	2N5488 Max.	Units	Test Conditions
D.C. Current Gain (Note 3)	h_{FE}	100	300	40	120	—	$I_C = 1A, V_{CE} = 2V$
D.C. Current Gain	h_{FE}	80		35		—	$I_C = 50mA, V_{CE} = 2V$
D.C. Current Gain (Note 3)	h_{FE}	25		15		—	$I_C = 5A, V_{CE} = 5V$
Collector Saturation Voltage (Note 3)	V_{CE} (sat)		0.25		0.25	V	$I_C = 1A, I_B = 100mA$
Collector Saturation Voltage (Note 3)	V_{CE} (sat)		1.0		1.0	V	$I_C = 5A, I_B = 500mA$
Base Saturation Voltage (Note 3)	V_{BE} (sat)		1.2		1.2	V	$I_C = 1A, I_B = 100mA$
Base Saturation Voltage (Note 3)	V_{BE} (sat)		1.8		1.8	V	$I_C = 5A, I_B = 500mA$
Collector-Emitter Breakdown Voltage (Note 3)	BV_{CER}	120		150		V	$I_C = 10mA, R_{BE} = 10$ ohms
Collector-Emitter Breakdown Voltage (Note 3)	BV_{CEO}	80		100		V	$I_C = 100mA, I_B = 0$
Emitter-Base Breakdown Voltage	BV_{EBO}	8		8		V	$I_E = 10\mu A, I_C = 0$
Collector Cutoff Current	I_{CES}		0.1			μA	$V_{CE} = 80V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}				0.1	μA	$V_{CE} = 100V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}		10			μA	$V_{CE} = 120V, R_{BE} = 0$
Collector Cutoff Current	I_{CES}				10	μA	$V_{CE} = 150V, R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}		50			μA	$V_{CE} = 80V, R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}				50	μA	$V_{CE} = 100V, R_{BE} = 0$
Collector Capacitance	C_{ob}		75		75	pf	$V_{CB} = 10V, I_E = 0$
A.C. Current Gain	h_{fe}	4		4			$I_C = 200mA, V_{CE} = 5V, f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}		125		125	ns	$I_C = 1A$ — 2N5487 See Fig. 1
Switching Speeds — Turn-off Time	t_{off}		450		550	ns	$I_C = 1A$ — 2N5488 See Fig. 2

Notes:
1. The device may be switched between maximum rated collector current and maximum rated collector-emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Steady state limits based on a maximum junction temperature of 200°C. High pulse power dissipation may cause second breakdown. Consult the factory on high power, low duty cycle application.
3. Pulse length = 300 μs; duty cycle $\leqslant$2%.

†All values in this table are JEDEC registered.

Maximum Safe Operating Area



Switching Speed Circuit

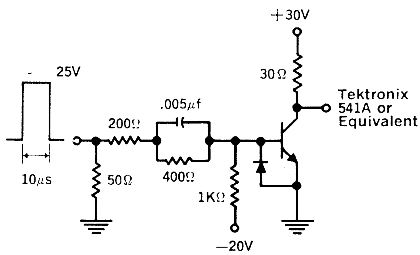


Figure 1

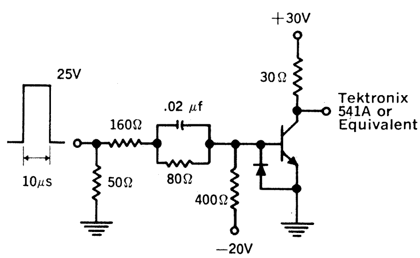


Figure 2

POWER TRANSISTORS

2N5552 5552-4

10 Amp, 120V, Planar NPN

FEATURES

- Collector-Base Voltage: up to 120V
- Peak Collector Current: 10A
- Fast Switching
- Beta Guaranteed at 3 Current Levels

DESCRIPTION

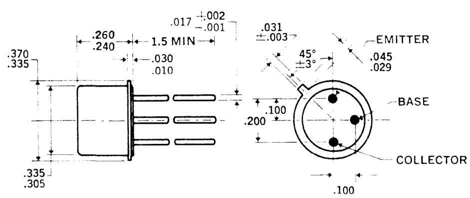
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5552 5552-4
Collector-Base Voltage, V_{CBO}	120V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	7V
D.C. Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.25W
100°C Case	15W
Operating and Storage Temperature Range	−65°C to 200°C

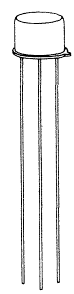
MECHANICAL SPECIFICATIONS

2N5552

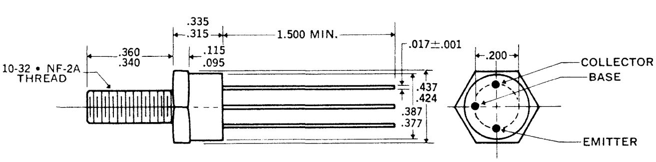


Dimensions in inches.

TO-5

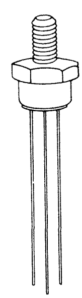


5552-4



Dimensions in inches.

TO-5 (Stud)



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

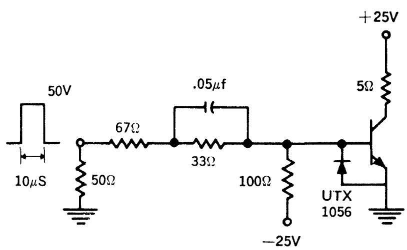
Test		Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain		h_{FE}	40	250	—	$I_C = 0.5A$, $V_{CE} = 2V$
D.C. Current Gain (Note 2)		h_{FE}	50	150	—	$I_C = 5A$, $V_{CE} = 5V$
D.C. Current Gain (Note 2)		h_{FE}	30	—	—	$I_C = 10A$, $V_{CE} = 5V$
Collector Saturation Voltage (Note 2)		V_{CE} (sat)	—	0.5	V	$I_C = 5A$, $I_B = 0.5A$
Collector Saturation Voltage (Note 2)		V_{CE} (sat)	—	1.0	V	$I_C = 10A$, $I_B = 1A$
Base Saturation Voltage (Note 2)		V_{BE} (sat)	—	1.3	V	$I_C = 5A$, $I_B = 0.5A$
Base Saturation Voltage (Note 2)		V_{BE} (sat)	—	1.8	V	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)		BV_{CER}	120	—	V	$I_C = 100mA$, $R_{BE} = 10\Omega$
Collector-Emitter Sustaining Voltage (Note 2)		V_{CEO} (sus)	80	—	V	$I_C = 100mA$, $I_B = 0$
Collector-Emitter Voltage (Note 2)		BV_{CES}	120	—	V	$I_C = 0.2\mu A$, $R_{BE} = 0$
Emitter-Base Breakdown Voltage		BV_{EBO}	7	—	V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current		I_{CES}	—	0.2	μA	$V_{CE} = 120V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C		I_{CES}	—	0.1	mA	$V_{CE} = 80$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance		C_{obo}	—	150	pf	$V_{CB} = 10$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain		h_{fe}	3	—	—	$I_C = 0.5A$, $V_{CE} = 5V$ $f = 10MHz$
Switching Speeds	Turn-on Time	t_{on}	—	100	ns	$I_C = 5A$
	Turn-off Time	t_{off}	—	700	ns	$I_{b1} = 250ma$ $I_{b2} = -250ma$

Notes:

1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ≤2%.

† All values in this table are JEDEC registered.

Switching Speed Circuit



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PRINTED IN U.S.A.

POWER TRANSISTORS

20 Amp, 80V, Planar NPN

2N5658
2N5659

FEATURES

- Collector-Base Voltage: up to 120V
- Peak Collector Current: 20A
- High Gain
- Fast Switching

DESCRIPTION

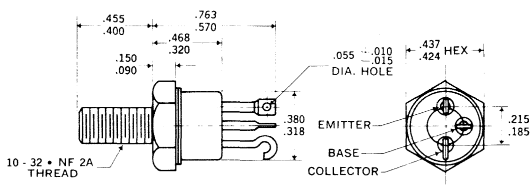
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N5658 2N5659
Collector-Base Voltage, V_{CBO}	120V
Collector-Emitter Voltage, V_{CEO}	80V
Emitter-Base Voltage, V_{EBO}	7V
Peak Collector Current, I_C	20A
Power Dissipation	
100°C Case	30W
Operating and Storage Temperature Range	−65°C to 200°C

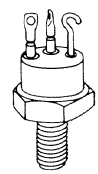
MECHANICAL SPECIFICATIONS

2N5658

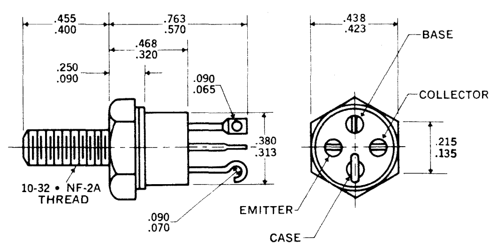


Dimensions in inches.

TO-59



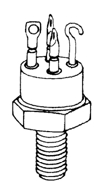
2N5659



Dimensions in inches.

Collector Isolated from Case.

TO-111



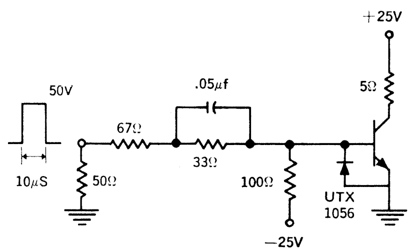
UNITRODE

Electrical Specifications (at 25°C unless noted)†

Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	250	—	$I_C = 0.5A$, $V_{CE} = 2V$
D.C. Current Gain	h_{FE}	50	150	—	$I_C = 5A$, $V_{CE} = 5V$ (Note 1)
D.C. Current Gain	h_{FE}	30		—	$I_C = 10A$, $V_{CE} = 5V$ (Note 1)
Collector Saturation Voltage	V_{CE} (sat)		.5	V	$I_C = 5A$, $I_B = 0.5A$ (Note 1)
Collector Saturation Voltage	V_{CE} (sat)		1.0	V	$I_C = 10A$, $I_B = 1A$ (Note 1)
Base Saturation Voltage	V_{BE} (sat)		1.3	V	$I_C = 5A$, $I_B = 0.5A$ (Note 1)
Base Saturation Voltage	V_{BE} (sat)		1.8	V	$I_C = 10A$, $I_B = 1A$ (Note 1)
Collector-Emitter Breakdown Voltage	BV_{CER}	120		V	$I_C = 100mA$, $R_{BE} = 10\Omega$
Collector-Emitter Breakdown Voltage	BV_{CES}	120		V	$I_C = 0.2\mu A$, $R_{BE} = 0$
Collector-Emitter Breakdown Voltage	BV_{CEO}	80		V	$I_C = 100mA$, $I_B = 0$ (Note 1)
Emitter-Base Breakdown Voltage	BV_{EBO}	7		V	$I_E = 10\mu A$, $I_C = 0$
Collector Cutoff Current	I_{CES}		0.2	μA	$V_{CE} = 120V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}		0.1	mA	$V_{CE} = 80V$, $R_{BE} = 0$, $T = 150°C$
Collector Capacitance	C_{obo}		150	pf	$V_{CB} = 10V$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	3			$I_C = 0.5A$, $V_{CE} = 5V$, $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}		150	ns	$I_C = 5A$
Switching Speeds — Turn-off Time	t_{off}		800	ns	$I_{b1} = 250mA$ $I_{b2} = -250mA$ Note 2.

Notes:
1. Pulse length = 300 μs; duty cycle ≤2%
2. Measured in saturated switching speed circuit.
† All Values in This Table are JEDEC Registered.

Switching Speed Circuit



POWER TRANSISTORS
2 Amp, 300V, Planar NPN

JAN, JANTX, & JANTXV 2N5660
JAN, JANTX, & JANTXV 2N5661
JAN, JANTX, & JANTXV 2N5662
JAN, JANTX, & JANTXV 2N5663

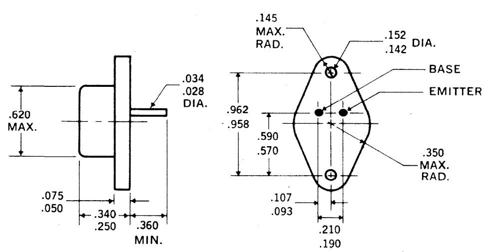
FEATURES
- Meets MIL-S-19500/454
- Collector-Base Voltage: up to 400V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching

DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS	JAN, JANTX, & JANTXV 2N5660	JAN, JANTX, & JANTXV 2N5661	JAN, JANTX, & JANTXV 2N5662	JAN, JANTX, & JANTXV 2N5663
Collector-Base Voltage, V_{CBO}	250V	400V	250V	400V
Collector-Emitter Voltage, V_{CEO}	200V	300V	200V	300V
Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V
D.C. Collector Current, I_C	2A	2A	2A	2A
Peak Collector Current, I_C	5A	5A	5A	5A
Power Dissipation				
25°C Ambient	2.0W	2.0W	1.2W	1.2W
100°C Case	20W	20W	15W	15W
Operating and Storage Temperature Range				−65°C to 200°C

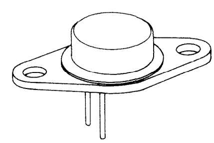
MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 2N5660 JAN, JANTX, & JANTXV 2N5661

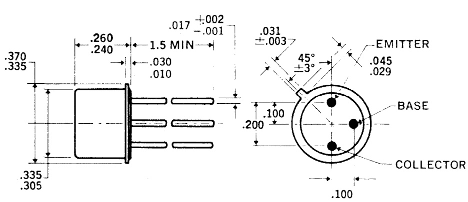


Dimensions in inches.

TO-66

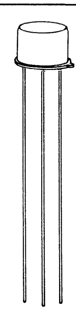


JAN, JANTX, & JANTXV 2N5662 JAN, JANTX, & JANTXV 2N5663



Dimensions in inches.

TO-5



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5660, 2N5662

Test	Symbol	Min.	Max.	Units	/454 Sub group	MIL-STD-750 Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	250	—	Vdc	A-2	3011	I_C = 10mAdc; R_{BE} = 100Ω; Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	200	—	Vdc	A-2	3011	I_C = 10mAdc; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	I_E = 10μAdc; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	V_{CE} = 200Vdc; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	V_{CB} = 200Vdc; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	V_{CB} = 250Vdc; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	40	—	—	A-3	3076	I_C = 50mAdc, V_{CE} = 2Vdc
D.C. Current Gain (Note 1)	h_{FE}*	40	120	—	A-3	3076	I_C = 0.5Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}*	15	—	—	A-3	3076	I_C = 1Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	I_C = 2Adc, V_{CE} = 5Vdc
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$*	—	0.4	Vdc	A-3	3071	I_C = 1Adc, I_B = 0.1Adc
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	0.8	Vdc	A-3	3071	I_C = 2Adc, I_B = 0.4Adc
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$*	—	1.2	Vdc	A-3	3066	I_C = 1Adc, I_B = 0.1Adc; Cond. A
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$	—	1.5	Vdc	A-3	3066	I_C = 2Adc, I_B = 0.4Adc; Cond. A
Gain-Bandwidth Product	f_T*	20	70	MHz	A-4	3306	I_C = 0.1Adc, V_{CE} = 5Vdc, f = 10MHz
Output Capacitance	C_{ob}	—	45	pf	A-4	3236	V_{CB} = 10Vdc, I_E = 0, f = 1MHz
Thermal Resistance	Θ_{J-C}				C-1	3151	
2N5660		—	5.0	°C/W			
2N5662		—	6.7	°C/W			
Switching Speeds — Turn-on time	t_{on}*	—	0.25	μs	A-4	—	I_C = 0.5Adc
Switching Speeds — Turn-off time	t_{off}*	—	0.85	μs	A-4	—	
100°C							
Forward Biased Second Breakdown							
2N5660	$I_{S/B}$	2	—	Adc	B-6	3051	V_{CE} = 10Vdc, t = 1Sec
	$I_{S/B}$	0.5	—	Adc	B-6	3051	V_{CE} = 40Vdc, t = 1Sec
	$I_{S/B}$	36	—	mAdc	B-6	3051	V_{CE} = 200Vdc, t = 1Sec
2N5662	$I_{S/B}$	2	—	Adc	B-7	3051	V_{CE} = 7.5 Vdc, t = 1Sec
	$I_{S/B}$	0.6	—	Adc	B-7	3051	V_{CE} = 25Vdc, t = 1Sec
	$I_{S/B}$	27	—	mAdc	B-7	3051	V_{CE} = 200Vdc, t = 1Sec
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	0.2	—	mj	B-8	3053	I_C = 2Adc, L = 0.1 mh
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	80	—	mj	B-9	3053	I_C = 2Adc, L = 40mh, V_{clamp} = 200V
150°C							
Collctor-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	V_{CE} = 200Vdc, Cond. C
—65°C							
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	A-6	3076	I_C = 0.5Adc, V_{CE} = 5Vdc

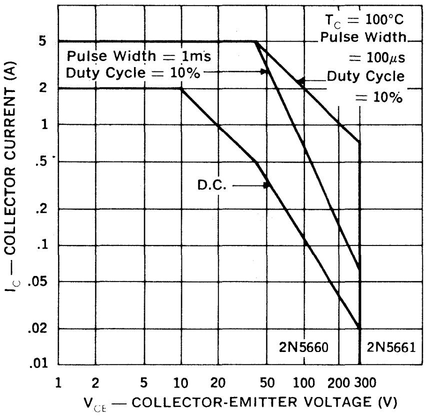
Notes
1. Pulse length = 300 μs; duty cycle ≤2%.
* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5661, 2N5663

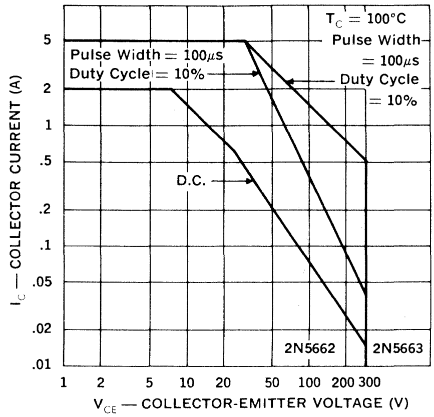
Test	Symbol	Min.	Max.	Units	/454 Sub group	MIL-STD-750 Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	400	—	Vdc	A-2	3011	I_C = 10mAdc; R_{BE} = 100Ω; Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	300	—	Vdc	A-2	3011	I_C = 10mAdc; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	I_E = 10μAdc; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	V_{CE} = 300Vdc; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	V_{CB} = 300Vdc; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	V_{CB} = 400Vdc; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	25	—	—	A-3	3076	I_C = 50mAdc, V_{CE} = 2Vdc
D.C. Current Gain (Note 1)	h_{FE}*	25	75	—	A-3	3076	I_C = 0.5Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}*	15	—	—	A-3	3076	I_C = 1Adc, V_{CE} = 5Vdc
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	I_C = 2Adc, V_{CE} = 5Vdc
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$*	—	0.4	Vdc	A-3	3071	I_C = 1Adc, I_B = 0.1Adc
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	0.8	Vdc	A-3	3071	I_C = 2Adc, I_B = 0.4Adc
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$*	—	1.2	Vdc	A-3	3066	I_C = 1Adc, I_B = 0.1Adc; Cond. A
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$	—	1.5	Vdc	A-3	3066	I_C = 2Adc, I_B = 0.4Adc; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	I_C = 0.2Adc, V_{CE} = 10Vdc, f = 10MHz
Output Capacitance	C_{ob}	—	45	pf	A-4	3236	V_{CB} = 10Vdc, I_E = 0, f = 1MHz
Thermal Resistance	Θ_{J-C}				C-1	3151	
2N5661		—	5.0	°C/W			
2N5663		—	6.7	°C/W			
Switching Speeds — Turn-on time	t_{on}*	—	0.25	μs	A-4	—	I_C = 0.5Adc
Switching Speeds — Turn-off time	t_{off}*	—	1.2	μs	A-4	—	
100°C							
Forward Biased Second Breakdown							
2N5661	$I_{S/B}$	2	—	Adc	B-6	3051	V_{CE} = 10Vdc, t = 1Sec
	$I_{S/B}$	0.5	—	Adc	B-6	3051	V_{CE} = 40Vdc, t = 1Sec
	$I_{S/B}$	19	—	mAdc	B-6	3051	V_{CE} = 300Vdc, t = 1Sec
2N5663	$I_{S/B}$	2	—	Adc	B-7	3051	V_{CE} = 7.5 Vdc, t = 1Sec
	$I_{S/B}$	0.6	—	Adc	B-7	3051	V_{CE} = 25Vdc, t = 1Sec
	$I_{S/B}$	14	—	mAdc	B-7	3051	V_{CE} = 300Vdc, t = 1Sec
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	0.2	—	mj	B-8	3053	I_C = 2Adc, L = 0.1 mh
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	80	—	mj	B-9	3053	I_C = 2Adc, L = 40mh, V_{clamp} = 300V
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	V_{CE} = 300Vdc, Cond. C
−65°C							
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	A-6	3076	I_C = 0.5Adc, V_{CE} = 5Vdc

Notes
1. Pulse length = 300 μs; duty cycle ≤2%.
* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

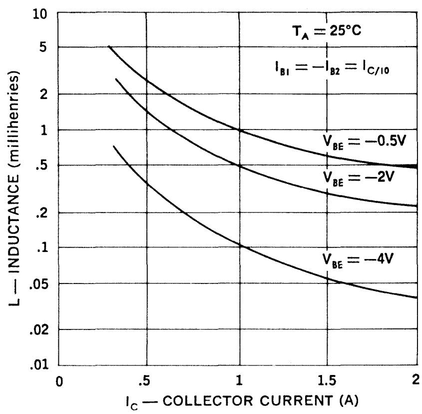
Forward Bias Safe Operating Area 2N5660, 2N5661



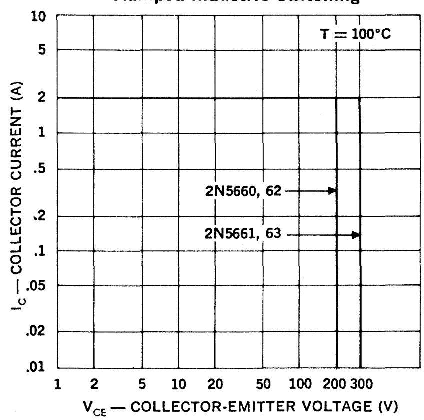
Forward Bias Safe Operating Area 2N5662, 2N5663



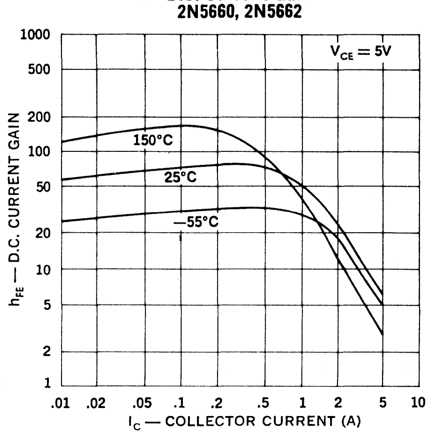
Unclamped Reverse Bias Second Breakdown



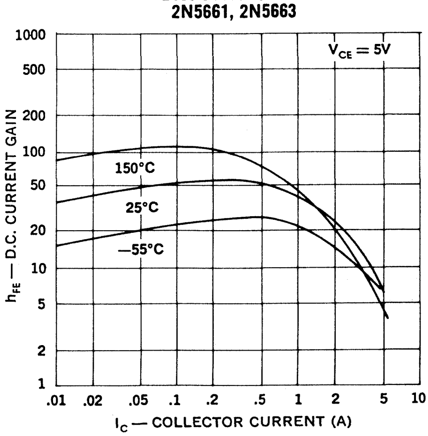
Reverse Bias Safe Operating Area Clamped Inductive Switching



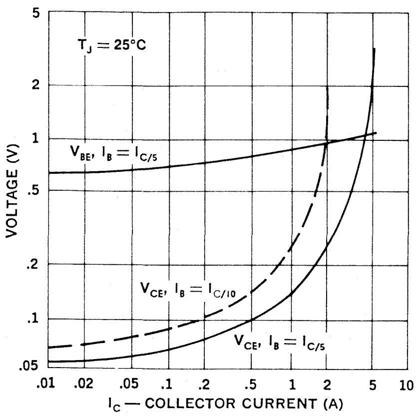
D.C. Current Gain 2N5660, 2N5662



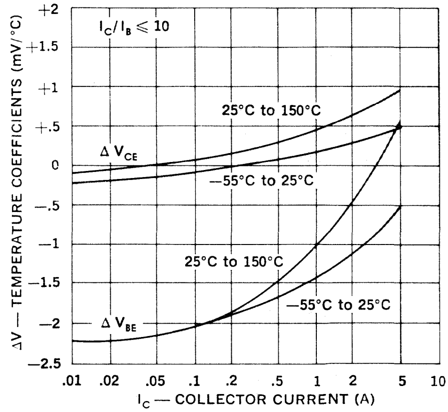
D.C. Current Gain 2N5661, 2N5663



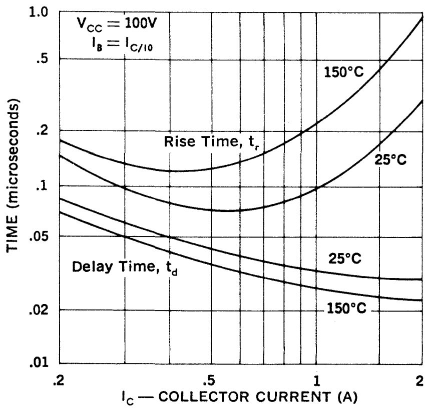
Saturation Voltages



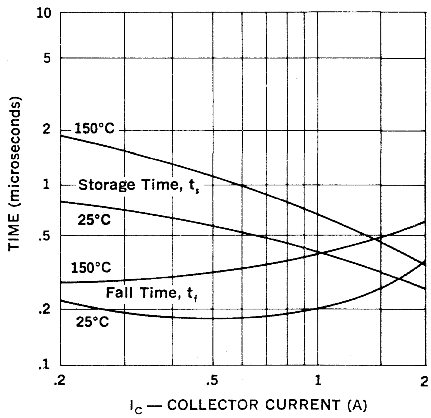
Saturation Voltage Temperature Coefficients



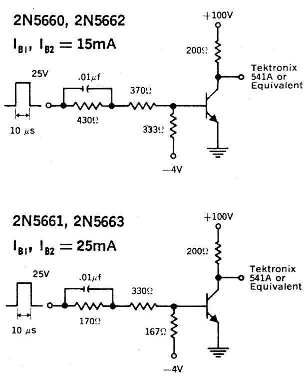
Switching Speed Characteristics



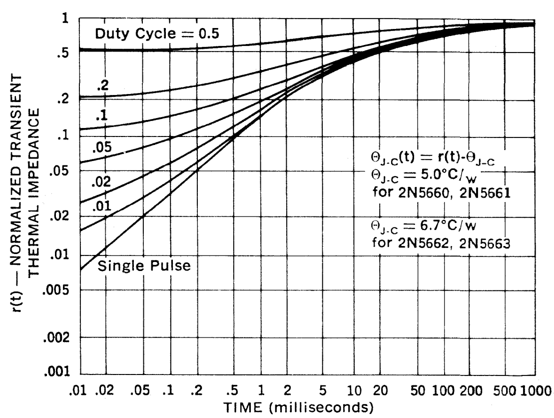
Switching Speed Characteristics



Switching Speed Circuits



Thermal Response



POWER TRANSISTORS
5 Amp, 300V, Planar NPN

JAN, JANTX, & JANTXV 2N5664
JAN, JANTX, & JANTXV 2N5665
JAN, JANTX, & JANTXV 2N5666
JAN, JANTX, & JANTXV 2N5667

FEATURES
- Meets MIL-S-19500/455
- Collector-Base Voltage: up to 400V
- D.C. Collector Current: 5A
- Peak Collector Current: 10A
- Fast Switching

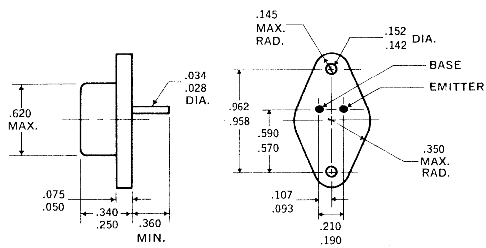
DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS

	JAN, JANTX, & JANTXV 2N5664	JAN, JANTX, & JANTXV 2N5665	JAN, JANTX, & JANTXV 2N5666	JAN, JANTX, & JANTXV 2N5667
Collector-Base Voltage, V_{CBO}	250V	400V	250V	400V
Collector-Emitter Voltage, V_{CEO}	200V	300V	200V	300V
Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V
D.C. Collector Current, I_C	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A
Power Dissipation				
25°C Ambient	2.5W	2.5W	1.2W	1.2W
100°C Case	30W	30W	15W	15W
Operating and Storage Temperature Range	—65°C to 200°C			

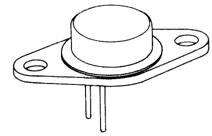
MECHANICAL SPECIFICATIONS

JAN, JANTX, & JANTXV 2N5664 JAN, JANTX, & JANTXV 2N5665

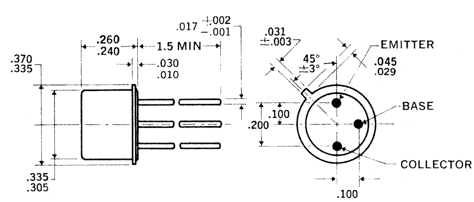


Dimensions in inches.

TO-66

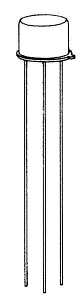


JAN, JANTX, & JANTXV 2N5666 JAN, JANTX, & JANTXV 2N5667



Dimensions in inches.

TO-5



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5664, 2N5666

Test	Symbol	Min.	Max.	Units	/455 Sub group	MIL-STD-750 Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	250	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\,\Omega$, Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	200	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6.0	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 200Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBO}	—	0.1	μAdc	A-2	3036	$V_{CB} = 200Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 250Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	40	—	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	40	120	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	15	—	—	A-3	3076	$I_C = 3Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)*	—	0.4	Vdc	A-3	3071	$I_C = 3Adc$, $I_B = 0.3Adc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	A-3	3071	$I_C = 5Adc$, $I_B = 1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)*	—	1.2	Vdc	A-3	3066	$I_C = 3Adc$, $I_B = 0.3Adc$; Cond. A
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	A-3	3066	$I_C = 5Adc$, $I_B = 1Adc$; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	90	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5664		—	3.3	°C/W			
2N5666		—	6.7	°C/W			
Switching Speeds — Turn-on Time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 1Adc$
Switching Speeds — Turn-off Time	t_{off}*	—	1.5	μs	A-4	—	
100°C							
Forward Biased Second Breakdown 2N5664	$I_{S/B}$	5	—	Adc	B-6	3051	$V_{CE} = 6Vdc$, $t = 1sec$
	$I_{S/B}$	0.75	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, $t = 1sec$
	$I_{S/B}$	43	—	mAdc	B-6	3051	$V_{CE} = 200Vdc$, $t = 1sec$
2N5666	$I_{S/B}$	5	—	Adc	B-7	3051	$V_{CE} = 3Vdc$, $t = 1sec$
	$I_{S/B}$	0.4	—	Adc	B-7	3051	$V_{CE} = 37.5Vdc$, $t = 1sec$
	$I_{S/B}$	27	—	mAdc	B-7	3051	$V_{CE} = 200Vdc$, $t = 1sec$
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	1.25	—	mj	B-8	3053	$I_C = 5Adc$, $L = 0.1mh$
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	500	—	mj	B-9	3053	$I_C = 5Adc$, $L = 40mh$, $V_{clamp} = 200V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 200Vdc$, Cond. C
−65°C							
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	A-6	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$

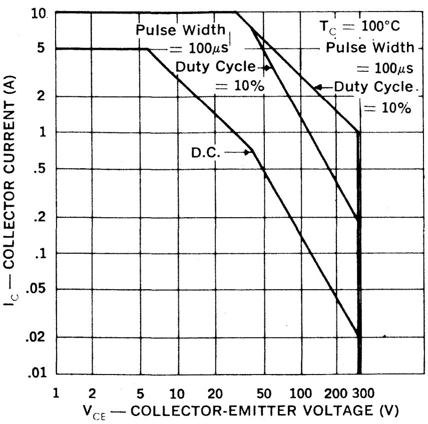
Notes
1. Pulse length = 300 μs; duty cycle ≤2%.
* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)
2N5665, 2N5667

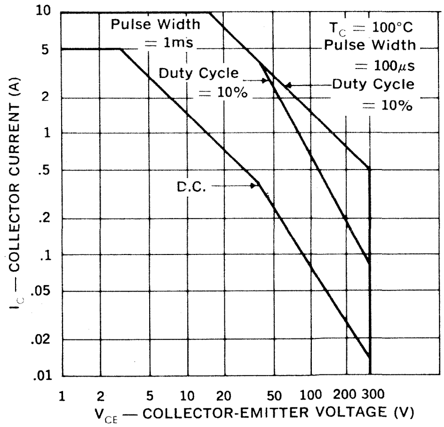
Test	Symbol	Min.	Max.	Units	/455 Sub group	MIL-STD-750	
						Method	Test conditions
Visual and mechanical					A-1	2071	See Mechanical Data
25°C							
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}*	400	—	Vdc	A-2	3011	$I_C = 10mAdc$; $R_{BE} = 100\ \Omega$, Cond. B
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}*	300	—	Vdc	A-2	3011	$I_C = 10mAdc$; Cond. D
Emitter-Base Breakdown Voltage	BV_{EBO}*	6	—	Vdc	A-2	3026	$I_E = 10\mu Adc$; Cond. D
Collector-Emitter Cutoff Current	I_{CES}*	—	0.2	μAdc	A-2	3041	$V_{CE} = 300Vdc$; Cond. C
Collector-Base Cutoff Current	I_{CBC}	—	0.1	μAdc	A-2	3036	$V_{CB} = 300Vdc$; Cond. D
Collector-Base Cutoff Current	I_{CBO}	—	1.0	mAdc	A-2	3036	$V_{CB} = 400Vdc$; Cond. D
D.C. Current Gain (Note 1)	h_{FE}*	25	—	—	A-3	3076	$I_C = 0.5Adc$, $V_{CE} = 2Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	25	75	—	A-3	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}*	10	—	—	A-3	3076	$I_C = 3Adc$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	A-3	3076	$I_C = 5Adc$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)*	—	0.4	Vdc	A-3	3071	$I_C = 3Adc$, $I_B = 0.6Adc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	A-3	3071	$I_C = 5Adc$, $I_B = 1Adc$
Base Saturation Voltage (Note 1)	V_{BE} (sat)*	—	1.2	Vdc	A-3	3066	$I_C = 3Adc$, $I_B = 0.6Adc$; Cond. A
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	A-3	3066	$I_C = 5Adc$, $I_B = 1Adc$; Cond. A
Gain-Bandwith Product	f_T*	20	70	MHz	A-4	3306	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Output Capacitance	C_{ob}	—	90	pf	A-4	3236	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Thermal Resistance	θ_{J-C}				C-1	3151	
2N5665		—	3.3	°C/W			
2N5667		—	6.7	°C/W			
Switching Speeds — Turn-on time	t_{on}*	—	0.25	μs	A-4	—	$I_C = 1Adc$
Switching Speeds — Turn-off time	t_{off}*	—	2.0	μs	A-4	—	
100°C							
Forward Biased Second Breakdown 2N5665	$I_{S/B}$	5	—	Adc	B-6	3051	$V_{CE} = 6Vdc$, $t = 1sec$
	$I_{S/B}$	0.75	—	Adc	B-6	3051	$V_{CE} = 40Vdc$, $t = 1$ sec
	$I_{S/B}$	21	—	mAdc	B-6	3051	$V_{CE} = 300Vdc$, $t = 1sec$
2N5667	$I_{S/B}$	5	—	Adc	B-7	3051	$V_{CE} = 3Vdc$, $t = 1sec$
	$I_{S/B}$	0.4	—	Adc	B-7	3051	$V_{CE} = 37.5Vdc$, $t = 1sec$
	$I_{S/B}$	14	—	nAdc	B-7	3051	$V_{CE} = 300Vdc$, $t = 1sec$
Unclamped Reverse Biased Second Breakdown	$E_{S/B}$	1.25	—	mj	B-8	3053	$I_C = 5Adc$, $L = 0.1mh$
Clamped Reverse Biased Second Breakdown	$E_{S/B}$	500	—	mj	B-9	3053	$I_C = 5Adc$, $L = 40mh$, $V_{clamp} = 300V$
150°C							
Collector-Emitter Cutoff Current	I_{CES}*	—	100	μAdc	A-5	3041	$V_{CE} = 300Vdc$, Cond. C
—65°C							
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	A-6	3076	$I_C = 1Adc$, $V_{CE} = 5Vdc$

Notes
1. Pulse length = 300 μs; duty cycle ≤2%.
* Those parameters marked with a * are JEDEC registered and devices meeting these specifications are available as commercial 2N devices.

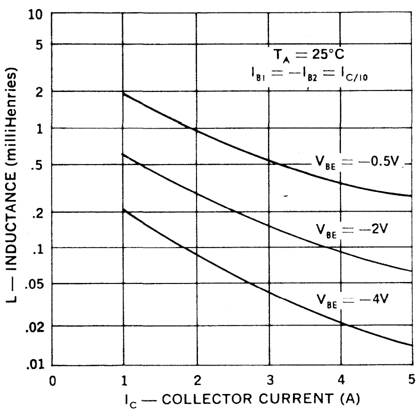
Forward Bias Safe Operating Area 2N5664, 2N5665



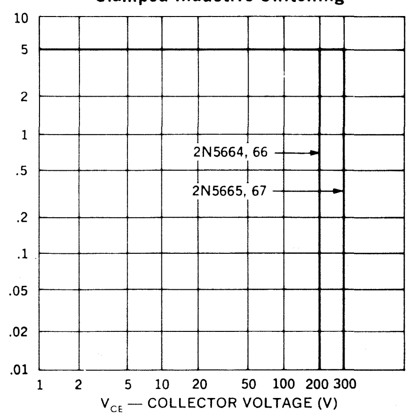
Forward Bias Safe Operating Area 2N5666, 2N5667



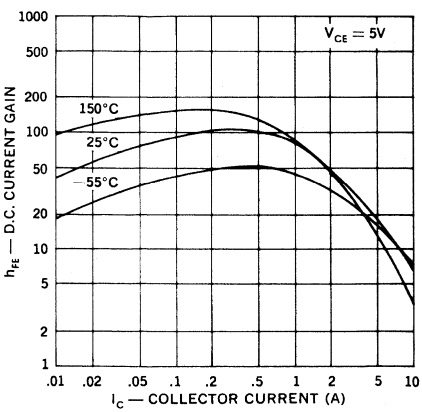
Unclamped Reverse Bias Second Breakdown



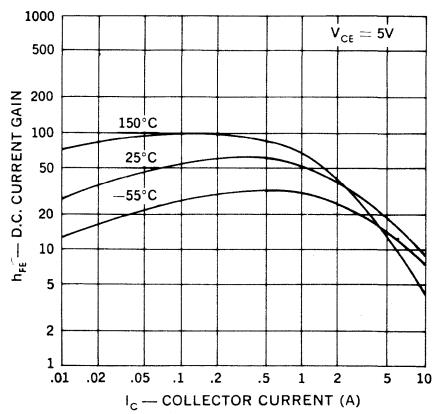
Reverse Bias Safe Operating Area Clamped Inductive Switching



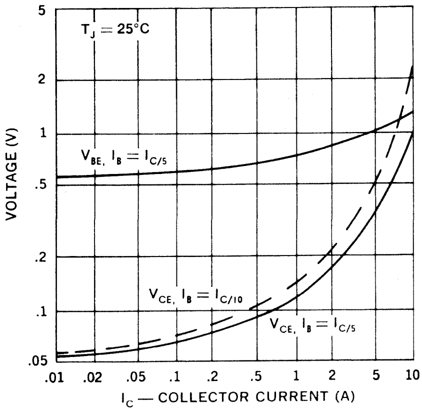
D.C. Current Gain 2N5664, 2N5666



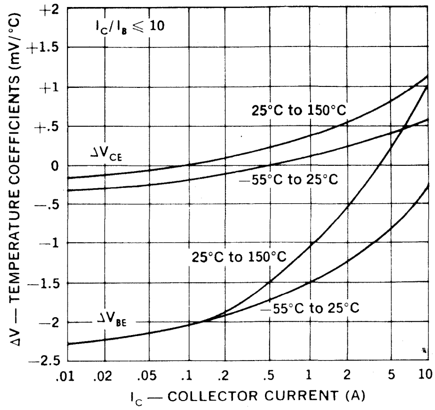
D.C. Current Gain 2N5665, 2N5667



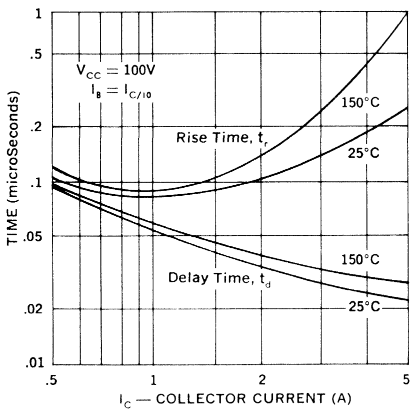
Saturation Voltages



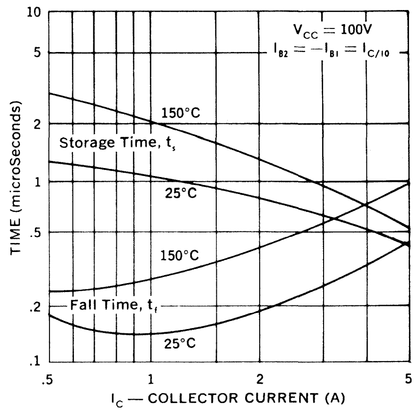
Saturation Voltage Temperature Coefficients



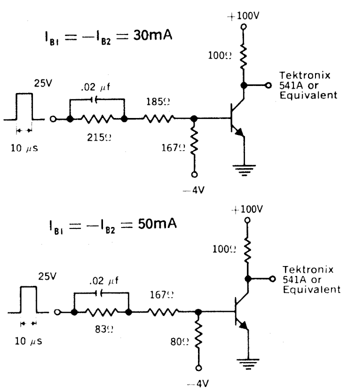
Switching Speed Characteristics



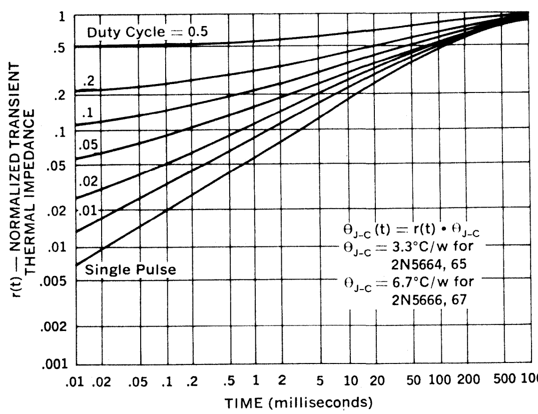
Switching Speed Characteristics



Switching Speed Circuits



Thermal Response



SCRs
1.6 Amp, Planar

2N5724-2N5728

FEATURES

- Maximum Gate Trigger Current: 20μA
- Closely Controlled Gate Trigger Voltage: .44 to .6V
- Operating Current Range: 2mA to 1.6A
- Voltage Ratings: to 400V
- Low On-State Voltage
- Specified for dv/dt and Switching Time

DESCRIPTION

These devices are intended for general purpose usage in Military/aerospace or severe industrial environments. Major design parameters are specified at the temperature extremes, thus permitting worst case design on the basis of guaranteed values. These devices undergo 100% preconditioning, which includes high temperature storage and temperature cycling followed by a fine leak test as a regular part of the manufacturing procedure.

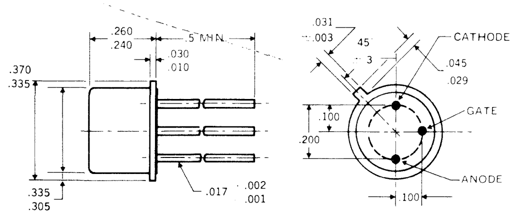
The high voltage types of the 2N5724 series are especially useful as pulse modulator switches in low to medium power pulse modulator applications. Specific parameters such as rise time, delay time, holding current, and recovery time can be selected for optimum performance in a pulse modulator circuit.

ABSOLUTE MAXIMUM RATINGS

	2N5724	2N5725	2N5726	2N5727	2N5728
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Off-State Voltage, V_{DSM}			500V		
D.C. On-State Current, I_T					
75°C Ambient			450mA		
85°C Case			1.6A		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current, $I_{G(AV)}$			25mA		
Reverse Gate Current, I_{GR}			3mA		
Reverse Gate Voltage, V_{GR}			6V		
Operating and Storage Temperature Range			−65°C to +150°C		

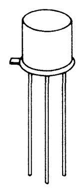
MECHANICAL SPECIFICATIONS

2N5724-2N5728



Dimensions in inches.

TO-39

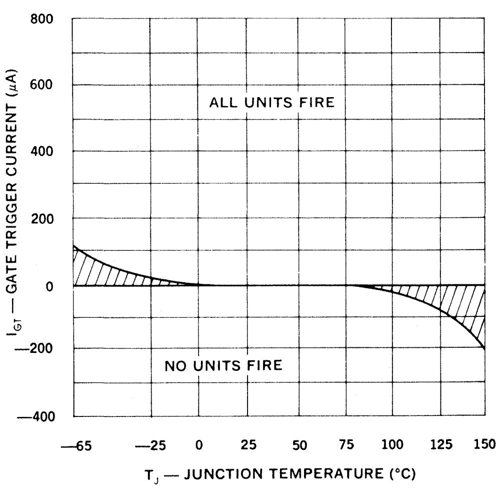


ELECTRICAL SPECIFICATIONS

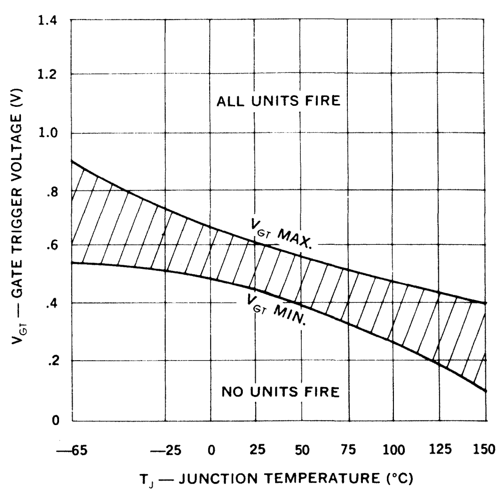
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual and Mechanical	—	—	—	—	—	
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.05	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.05	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Voltage	V_{GR}	5	8	—	V	$I_{GR} = 0.1mA$
Gate Trigger Current	I_{GT}	—	2	20	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.44	0.5	0.6	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	2.3	2.5	V	$I_T = 5A$ (pulse test)
Holding Current	I_H	0.3	0.8	2.0	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 3 (25°C TESTS)						
Off-State Voltage — Critical Rate of Rise	dv/dt	100	150	—	v/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	0.1	0.5	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.1	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.3	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time						
2N5724, 2N5725, 2N5726,	t_q	—	15	30	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 1K$
2N5727, 2N5728		—	30	50	μs	
SUBGROUP 4 (150°C TESTS)						
High Temp. Off-State Current	I_{DRM}	—	50	200	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	80	200	μA	$R_{GK} = 1K$, V_{RRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	0.10	0.15	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
High Temp. Holding Current	I_H	0.10	0.15	—	mA	$R_{GK} = 1K$, $V_D = 5V$
SUBGROUP 5 (—65°C TESTS)						
Low Temp. Gate Trigger Voltage	V_{GT}	—	0.7	0.9	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	50	125	μA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	—	1.2	3.0	mA	$R_{GK} = 1K$, $V_D = 5V$

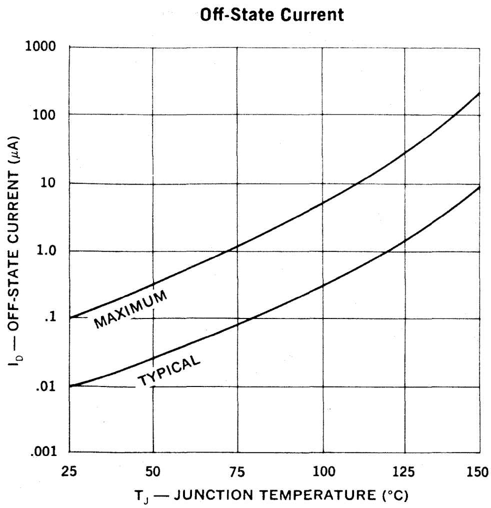
Note 1 See rating curves for full rating information.
Note 2 Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1K or smaller, or other adequate gate bias is used.

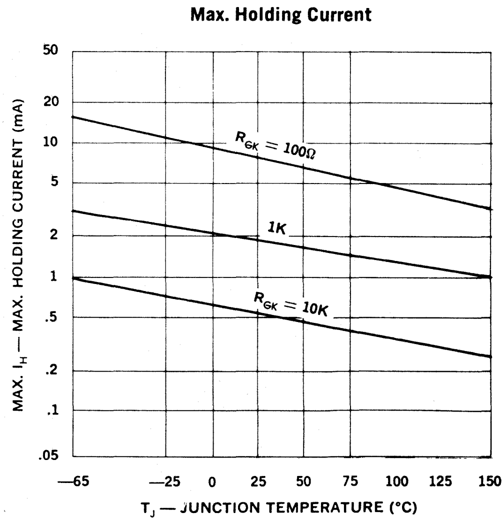
Gate Trigger Current

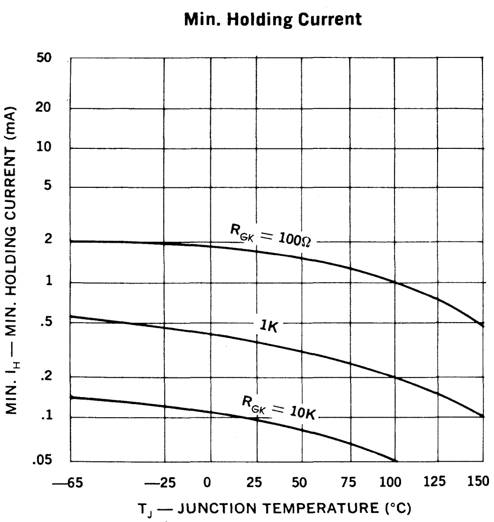


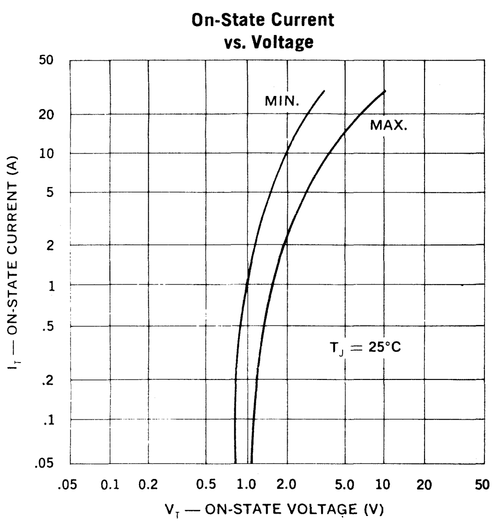
Gate Trigger Voltage



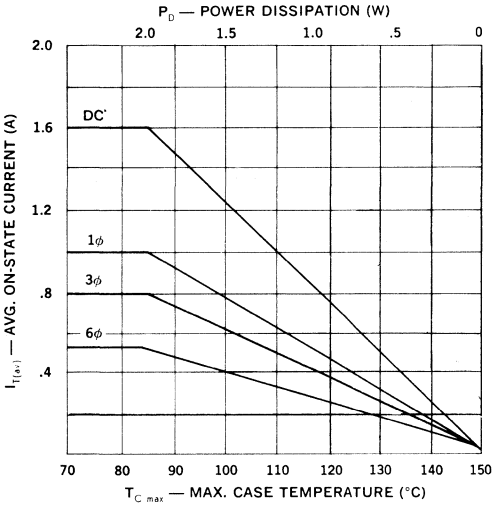

Off-State Current
1000
100
10
1.0
.1
.01
.001
I_D — OFF-STATE CURRENT (μA)
MAXIMUM
TYPICAL
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)


Max. Holding Current
50
20
10
5
2
1
.5
.2
.1
.05
MAX. I_H — MAX. HOLDING CURRENT (mA)
R_{GK} = 100Ω
1K
R_{GK} = 10K
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)

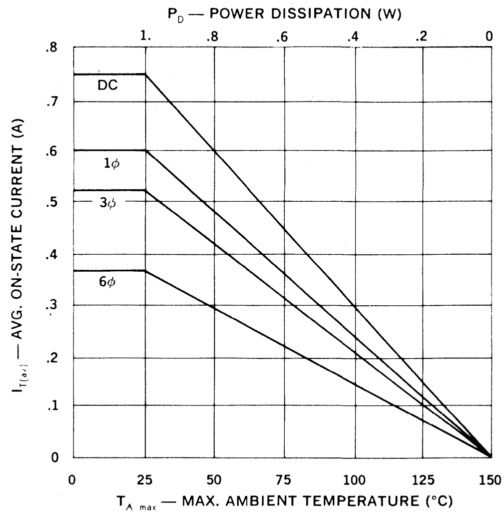

Min. Holding Current
50
20
10
5
2
1
.5
.2
.1
.05
MIN. I_H — MIN. HOLDING CURRENT (mA)
R_{GK} = 100Ω
1K
R_{GK} = 10K
—65
—25
0
25
50
75
100
125
150
T_J — JUNCTION TEMPERATURE (°C)


On-State Current
vs. Voltage
50
20
10
5
2
1
.5
.2
.1
.05
I_T — ON-STATE CURRENT (A)
MIN.
MAX.
T_J = 25°C
.05
0.1
0.2
0.5
1.0
2.0
5.0
10
20
50
V_T — ON-STATE VOLTAGE (V)

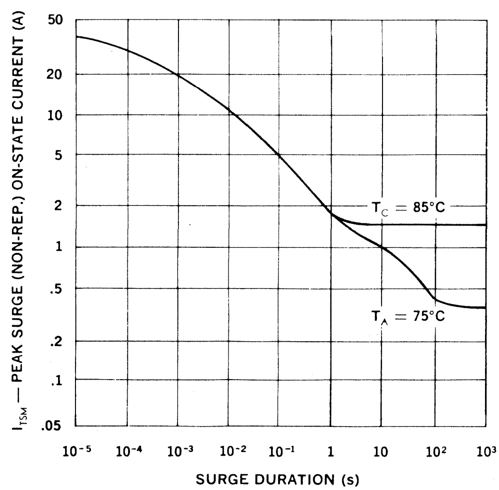
Avg. Current vs. Case Temperature



Avg. Current vs. Ambient Temperature



Surge Current



PUTs

2N6027-2N6028

Planar, TO-92, Plastic

FEATURES
- TO-98 Plastic Package
- Maximum Peak Current: 150nA
- Minimum Valley Current: 1.5mA
- Peak Forward Current: 5A
- Programmable Eta, R_{BB}, I_P and I_V
- Planar Passivated Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION
The Unitrode Programmable Unijunction Transistor is today's preferred device for low cost timing circuits, oscillators, sensing circuits and a wide range of other applications where a variable voltage level threshold is desired. Functionally equivalent to standard unijunction transistors, the Unitrode PUT offers the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming the Eta, R_{BB}, I_P, and I_V functions. For additional information see Unitrode Application Note U-66.

TYPICAL FEATURES
Programmable Turn-on
Programmable Turn-off
Low Leakage Current
High Output Pulse

TYPICAL APPLICATIONS

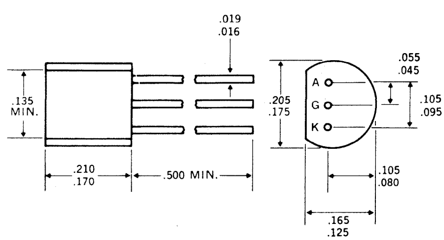
SCR Triggers	Delay Circuits
Timing Circuits	Sampling Circuits
Oscillators	Relay Drivers
Sweep Circuits	Smoke Detectors

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	—5V
Peak Recurrent Forward Current	
20μs, 1% Duty Cycle	2A
100μs, 1% Duty Cycle	1A
Peak Non-recurrent Forward Current, 10μs	5A
Power Dissipation	
25°C Ambient	375mW
Derating Factor	5mW/°C
Storage Temperature	—55°C to +125°C
Operating Temperature Range	—55°C to +100°C

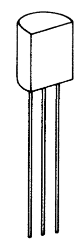
MECHANICAL SPECIFICATIONS

2N6027-2N6028



Dimensions in inches.

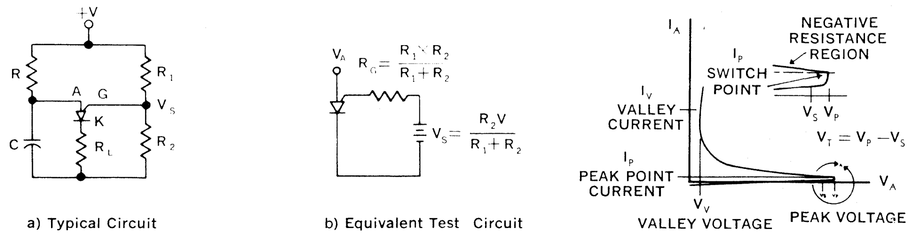
TO-92



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	2N6027 Min.	2N6027 Max.	2N6028 Min.	2N6028 Max.	Units	Test Conditions
Peak Current	I_P	1	— —	2 5	— —	0.15 1.0	μA μA	$R_G = 1M\Omega, V_S = 10V$ $R_G = 10k\Omega, V_S = 10V$
Valley Current	I_V	1	— 70 1.5	50 — —	— 25 1.0	25 — —	μA μA mA	$R_G = 1M\Omega, V_S = 10V$ $R_G = 10k\Omega, V_S = 10V$ $R_G = 200\Omega, V_S = 10V$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k\Omega, V_S = 10V$ $R_G = 1M\Omega, V_S = 10V$
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C, V_S = 40V$ $T = 75°C, V_S = 40V$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_S = 40V$
Forward Voltage	V_F	4	—	1.5	—	1.5	V	$I_F = 50mA$
Pulse Output Voltage	V_O	5	6	—	6	—	V	
Pulse Output Rise Time	t_r	5	—	80	—	80	ns	



a) Typical Circuit

b) Equivalent Test Circuit

Figure 1

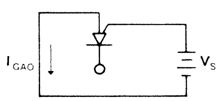


Figure 2

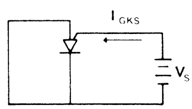


Figure 3

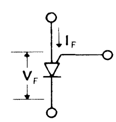


Figure 4

Note: Conditions for oscillation

$$\frac{V_{BB} - V_P}{R} > I_P$$

$$\frac{V_{BB} - V_V}{R} < I_V$$

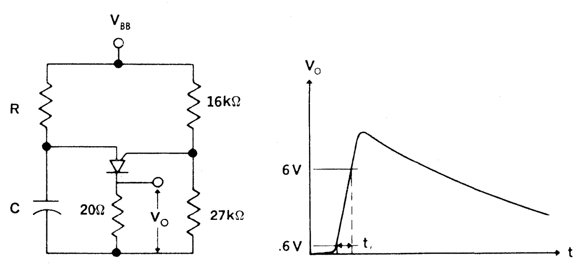
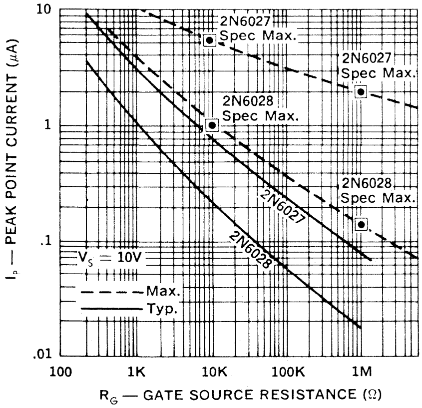
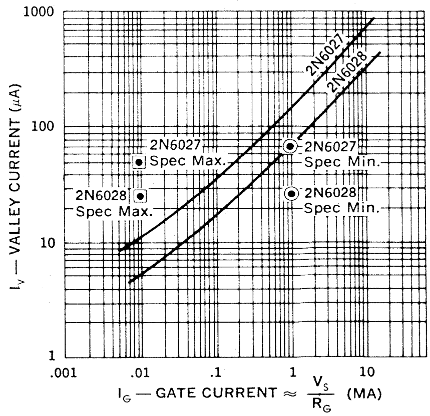


Figure 5

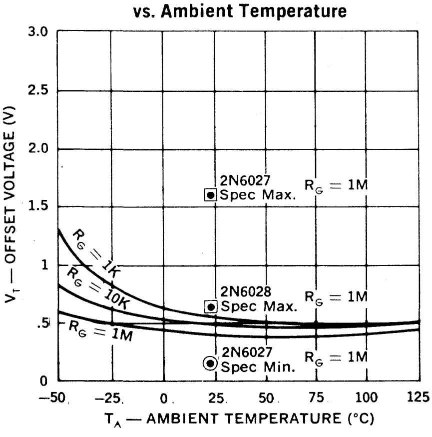
Peak Point Current vs. Gate Source Resistance



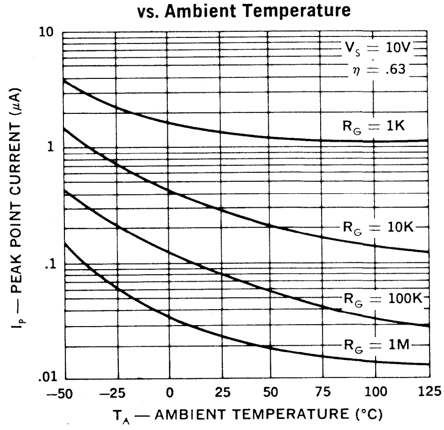
Valley Current vs. Gate Current

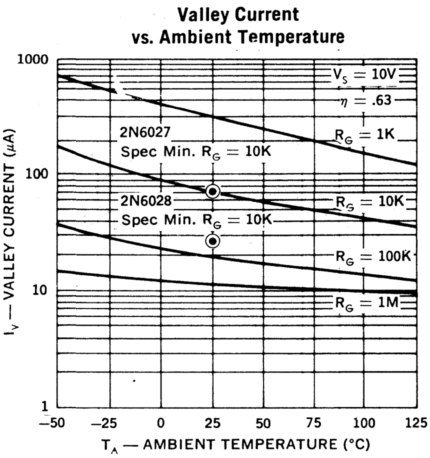


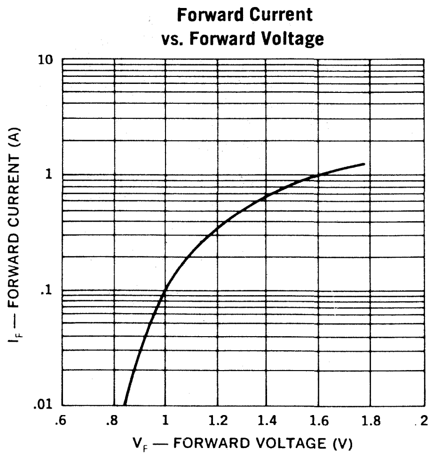
Offset Voltage vs. Ambient Temperature

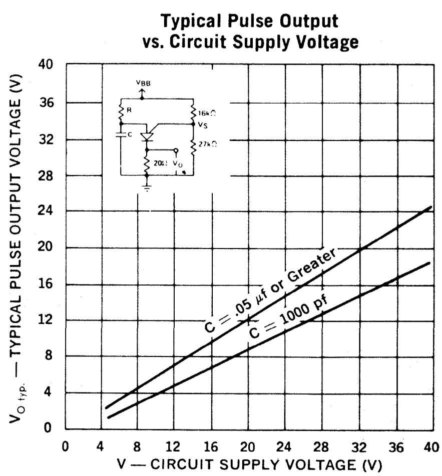


Peak Point Current vs. Ambient Temperature




Valley Current
vs. Ambient Temperature
V_S = 10V
η = .63
2N6027
Spec Min. R_G = 10K
R_G = 1K
2N6028
Spec Min. R_G = 10K
R_G = 10K
R_G = 100K
R_G = 1M
1000
100
10
1
–50 –25 0 25 50 75 100 125
I_V — VALLEY CURRENT (μA)
T_A — AMBIENT TEMPERATURE (°C)


Forward Current
vs. Forward Voltage
10
1
.1
.01
.6 .8 1 1.2 1.4 1.6 1.8 2
I_F — FORWARD CURRENT (A)
V_F — FORWARD VOLTAGE (V)


Typical Pulse Output
vs. Circuit Supply Voltage
C = .05 μf or Greater
C = 1000 pf
0 4 8 12 16 20 24 28 32 36 40
V — CIRCUIT SUPPLY VOLTAGE (V)
$V_{O\ typ.}$ — TYPICAL PULSE OUTPUT VOLTAGE (V)

PUTs

2N6119-2N6120

Planar, TO-18, Hermetic

FEATURES

- Hermetically Sealed TO-18 Metal Can
- Programmable Eta, R_{BB}, I_P and I_V
- Maximum Peak Point Current: 150nA
- Minimum Valley Current to 1.5mA
- Nano-Amp Leakage
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION

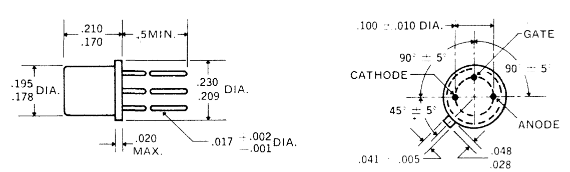
Functionally equivalent to standard unijunction transistors, Unitrode's Programmable Unijunction Transistors offer the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming Eta, R_{BB}, I_P and I_V functions. This series also features a hermetically sealed TO-18 package for optimum reliability in all environmental conditions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators and sensing circuits. For additional information see Unitrode Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	−5V
Peak Recurrent Forward Current	
10μs, 1% Duty Cycle	8A
100μs, 1% Duty Cycle	5A
Power Dissipation	
25°C Ambient	400mW
Derating Factor	3.2mW/°C
Storage Temperature	−55°C to +125°C
Operating Temperature Range	−55°C to +125°C

MECHANICAL SPECIFICATIONS

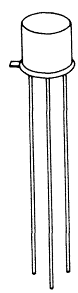
2N6119-2N6120



GATE CONNECTED TO CASE

Dimensions in inches.

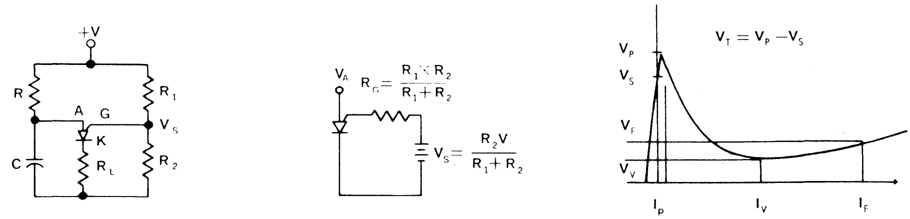
TO-18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	2N6119 Min.	2N6119 Max.	2N6120 Min.	2N6120 Max.	Units	Test Conditions
Peak Current	I_P	1	— —	5 2	— —	1.0 0.15	μA μA	$R_G = 10k$, $V_S = 10V$ $R_G = 1$ Meg.
Valley Current	I_V	1	70 — 1.5	— 50 —	25 — 1.0	— 25 —	μA μA mA	$R_G = 10k$, $V_S = 10V$ $R_G = 1$ Meg. $R_G = 200\Omega$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k$, $V_S = 10V$ $R_G = 1$ Meg.
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C$, $V_S = 40V$ $T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_S = 40V$
Forward Voltage	V_F	4	—	1.0	—	1.0	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	9	—	9	—	V	
Pulse Output Rate of Rise	t_r	5	—	80	—	80	ns	



a) Typical Circuit
b) Equivalent Test Circuit
c) Characteristic Curve

Figure 1

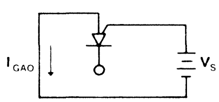


Figure 2

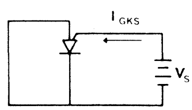


Figure 3

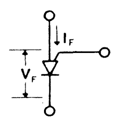


Figure 4

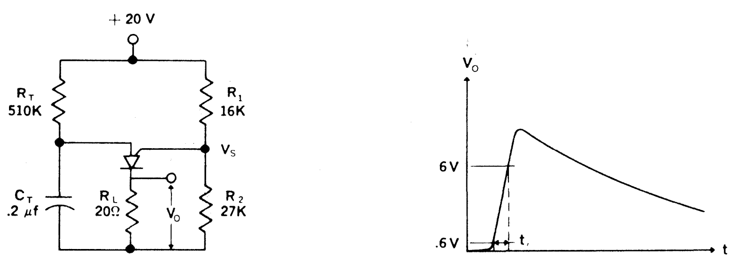
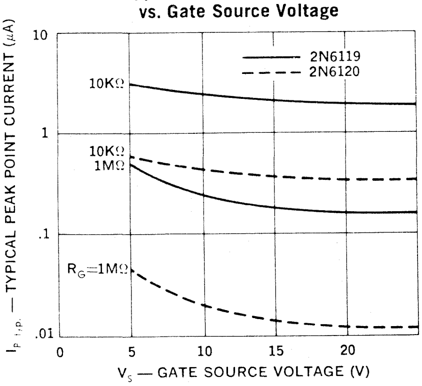
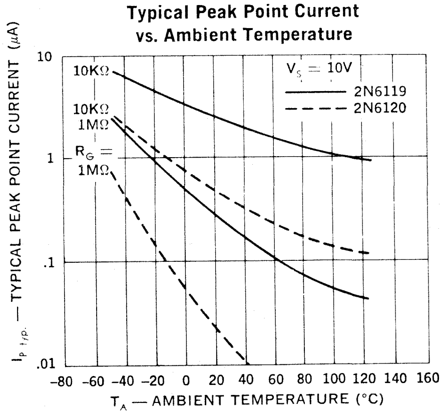


Figure 5

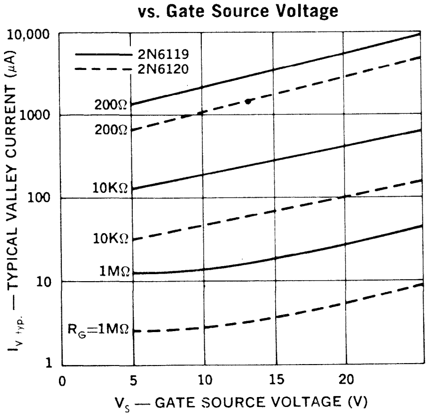
Typical Peak Point Current vs. Gate Source Voltage



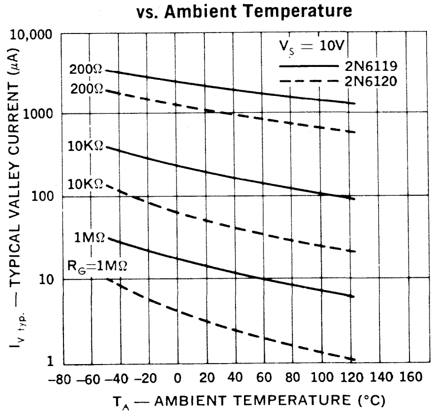
Typical Peak Point Current vs. Ambient Temperature



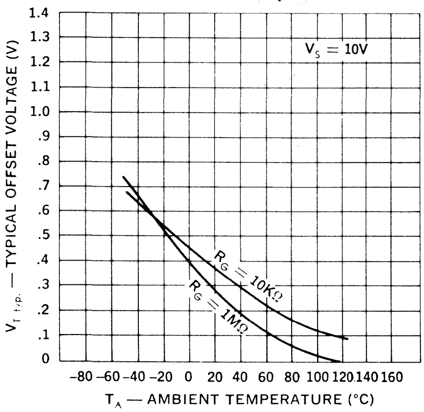
Typical Valley Current vs. Gate Source Voltage



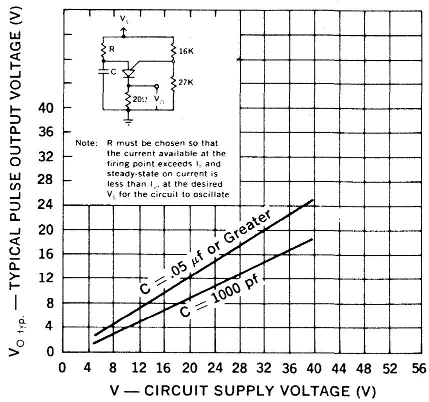
Typical Valley Current vs. Ambient Temperature



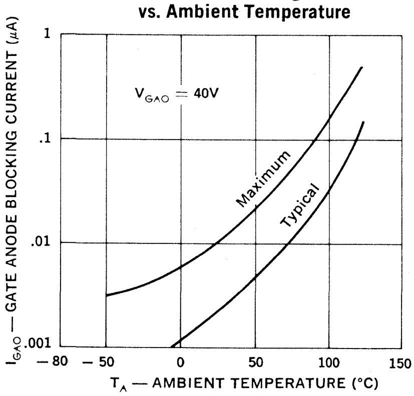
Typical Offset Voltage vs. Ambient Temperature



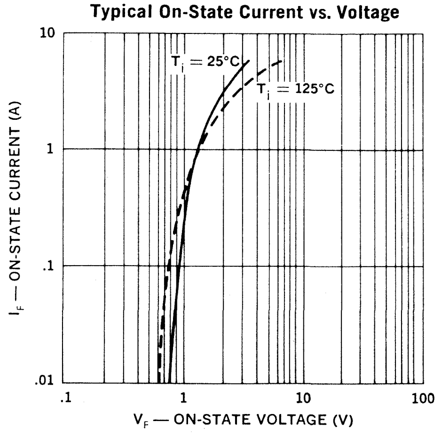
Typical Pulse Output vs. Circuit Supply Voltage



Gate-Anode Blocking Current vs. Ambient Temperature



Typical On-State Current vs. Voltage



PUTs

2N6137-2N6138

Military, Planar, TO-18, Hermetic

FEATURES

- Available as JAN and JAN TX types
- −55°C to +125°C Temperature Range for Timing and Oscillator Circuits
- $I_P \leqslant 10\mu A$ at $T = -55°C$
  $I_V \geqslant 40\mu A$ at $T = +125°C$
- Programmable η, R_{BB}, I_P and I_V
- Peak Recurrent Current: of 5A
- Low On-State Voltage Drop
- Hermetically Sealed Metal Case and Planar Passivated Construction for Maximum Reliability and Parameter Stability.

DESCRIPTION

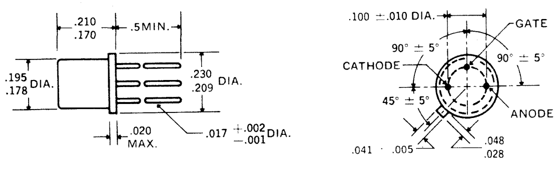
The Programmable Unijunction Transistor is functionally equivalent to a standard unijunction transistor with the advantage that external resistors can be used to program η, R_{BB}, I_P, and I_V, depending upon the designer's needs. The Unitrode device, in addition to allowing programmable versatility, is completely planar passivated and packaged in a TO-18 hermetically sealed package, which offers an order of magnitude improvement in inherent reliability over many similar devices. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators, and sensing circuits. For further application information see Unitrode Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

	2N6137	2N6138
Anode-to-Cathode Forward Voltage, V_{AK}	40V	100V
Anode-to-Cathode Reverse Voltage, V_{AKR}	40V	100V
Gate-to-Cathode Forward Voltage, V_{GK}	40V	100V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V	100V
Gate-to-Cathode Reverse Voltage, V_{GKR}	5V	5V
Peak Recurrent Forward Current, 10μs 1% Duty Cycle	5A	5A
Peak Gate Current, I_{GM}	250mA	250mA
Average Gate Current, $I_{G(AV)}$	50mA	50mA
Power Dissipation		
25°C Ambient	300mW	300mW
Derating Factor	2.4mW/°C	2.4mW/°C
Storage Temperature Range	−55°C to +125°C	
Operating Temperature Range	−55°C to +125°C	

MECHANICAL SPECIFICATIONS

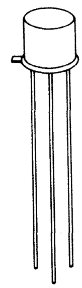
2N6137-2N6138



GATE CONNECTED TO CASE

Dimensions in inches.

TO-18

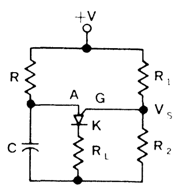


UNITRODE

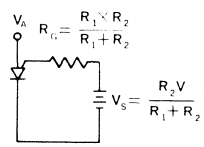
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)†

Test	Symbol	Figure	Minimum	Typical	Maximum	Units	Test Conditions
SUBGROUP 1 Visual and Mechanical	—	—	—	—	—	—	—
SUBGROUP 2							
Gate-anode blocking current	I_{GAO}	2	—	2	10	nA	V_{GA} = Rating
Gate-cathode blocking current	I_{GKS}	3	—	5	100	nA	V_{GK} = Rating
SUBGROUP 3							
Peak-point anode current	I_P	1	— —	1 2.5	2 5	μA μA	R_G = 1 Meg R_G = 10K } V_S = 10V
Peak-point offset voltage	V_T	1	0.2 0.2	0.26 0.35	1.6 0.6	V V	R_G = 1 Meg R_G = 10K } V_S = 10V
Valley-point anode current	I_V	1	— 70 1.5	15 200 2	50 — —	μA μA mA	R_G = 1 Meg R_G = 10K R_G = 200Ω } V_S = 10V
SUBGROUP 4							
Forward on-state voltage	V_F	4	—	0.85	1.0	V	I_F = 50mA
Peak pulse voltage	V_O	5	9	12	—	V	
Peak pulse voltage rise time	t_r	5	—	50	80	ns	
SUBGROUP 5							
Gate-anode blocking current (125°C Test)	I_{GAO}	2	—	150	500	nA	V_{GA} = Rating
Valley-point anode current (125°C Test)	I_V	1	40	100	—	μA	R_G = 10K, V_S = 10V
Peak-point anode current (—55°C Test)	I_P	1	—	7.5	10	μA	R_G = 10K, V_S = 10V

† All values in table are JEDEC registered



a) Typical Circuit



b) Equivalent Test Circuit

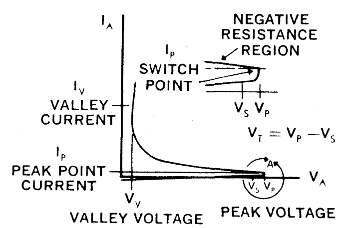


Figure 1

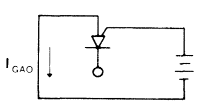


Figure 2

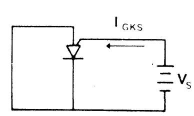


Figure 3

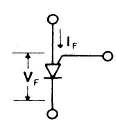


Figure 4

Note: Conditions for oscillation

$$\frac{V_{BB} - V_P}{R} > I_P$$

$$\frac{V_{BB} - V_V}{R} < I_V$$

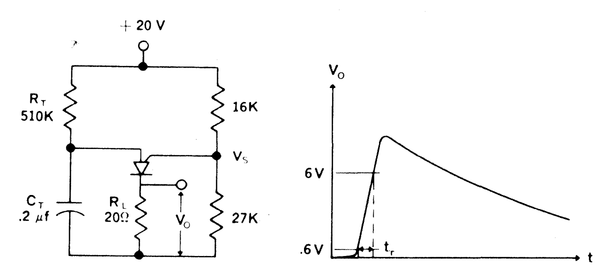
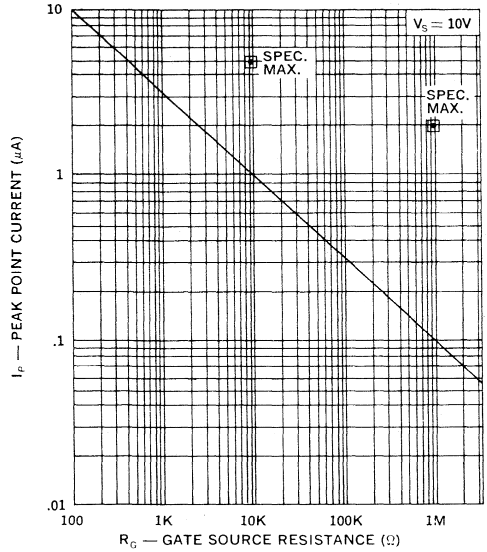
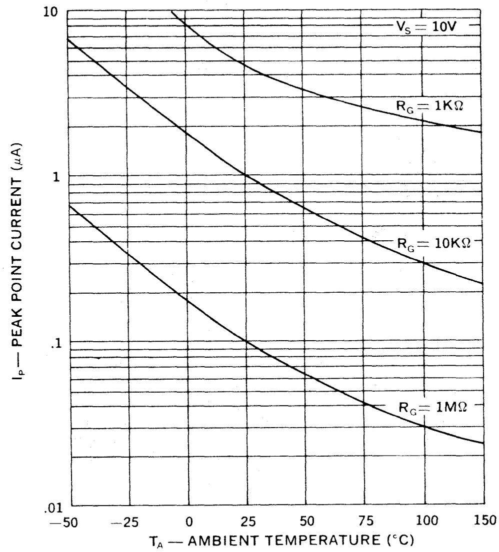


Figure 5

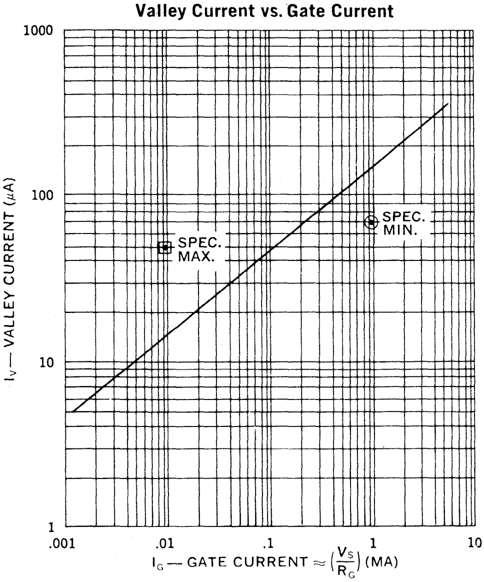
Peak Point Current vs. Gate Source Resistance



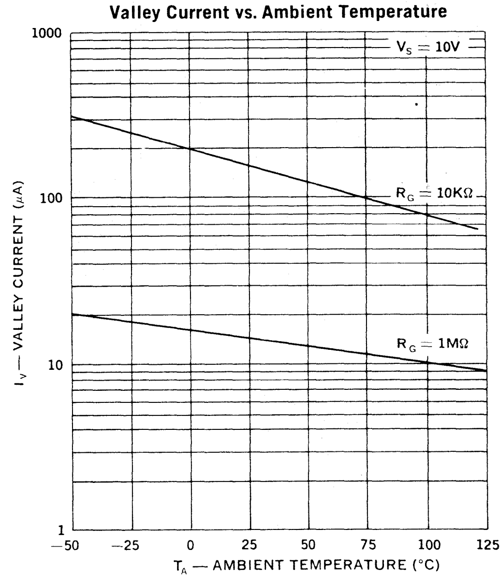
Peak Point Current vs. Ambient Temperature



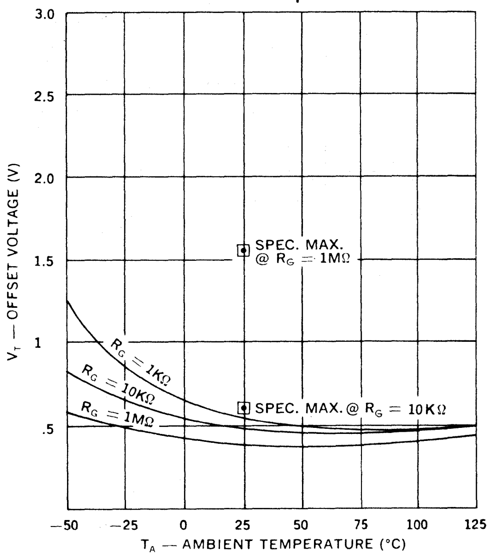
Valley Current vs. Gate Current



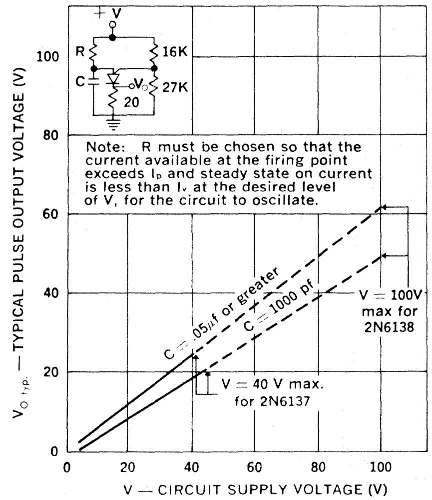
Valley Current vs. Ambient Temperature



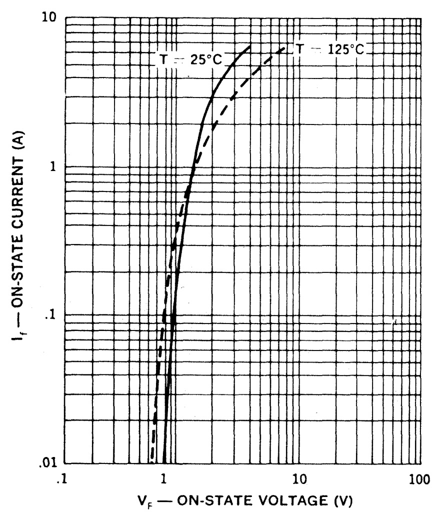
Offset Voltage vs. Ambient Temperature



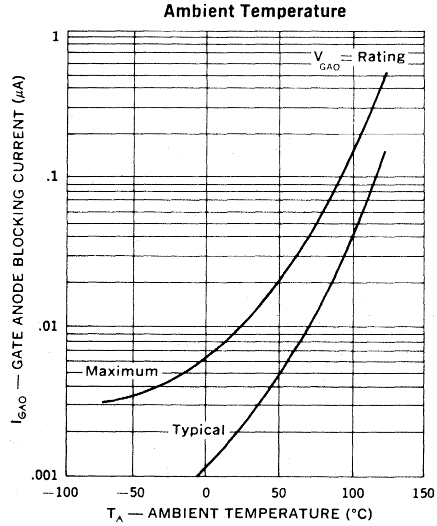
Typical Pulse Output Voltage vs. Circuit Supply Voltage



Typical Current vs. On-State Voltage



Gate-Anode Blocking Current vs. Ambient Temperature



POWER TRANSISTORS

10 Amp, 100V, Planar NPN

FEATURES

- Collector-Base Voltage: up to 140V
- D.C. Collector Current: 10A
- Fast Switching
- Low Saturation Voltage

DESCRIPTION

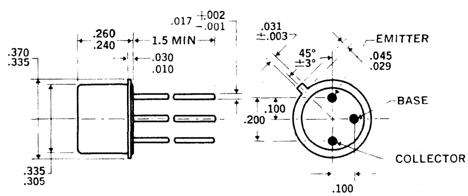
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	2N6232 6232-4
Collector-Base Voltage, V_{CBO}	140V
Collector-Emitter Voltage, V_{CEO}	100V
Emitter-Base Voltage, V_{EBO}	7V
D.C. Collector Current, I_C	10A
Power Dissipation	
25°C Ambient	1.25W
100°C Case	15W
Operating and Storage Temperature Range	—65°C to 200°C

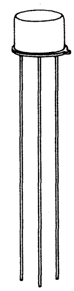
MECHANICAL SPECIFICATIONS

2N6232

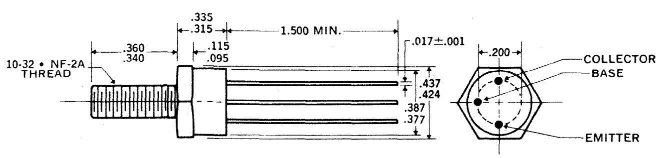


Dimensions in inches.

TO-5

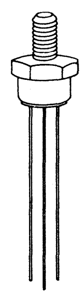


6232-4



Dimensions in inches.

TO-5 (Stud)



UNITRODE

Electrical Specification (at 25°C unless noted) †

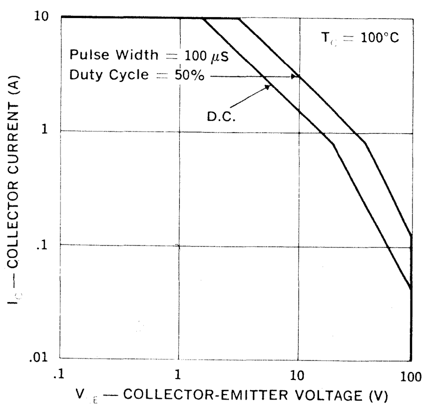
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain	h_{FE}	40	250	—	$I_C = 0.5A$, $V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	25	100	—	$I_C = 5A$, $V_{CE} = 2V$
D.C. Current Gain (Note 2)	h_{FE}	20	—	—	$I_C = 10A$, $V_{CE} = 5V$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	0.7	V	$I_C = 5A$, $I_B = 0.5A$
Collector Saturation Voltage (Note 2)	V_{CE} (sat)	—	1.4	V	$I_C = 10A$, $I_B = 1A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.4	V	$I_C = 5A$, $I_B = 0.5A$
Base Saturation Voltage (Note 2)	V_{BE} (sat)	—	1.8	V	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)	BV_{CER}	140	—	V	$I_C = 10mA$, $R_{BE} = 10\Omega$
Collector-Emitter Sustaining Voltage (Note 2)	V_{CEO} (sus)	100	—	V	$I_C = 100mA$, $I_B = 0$
Emitter-Cutoff Current	I_{EBO}	—	10	μA	$V_{EB} = 7V$
Collector Cutoff Current	I_{CES}	—	0.2	μA	$V_{CE} = 140V$, $R_{BE} = 0$
Collector Cutoff Current, 150°C	I_{CES}	—	0.1	mA	$V_{CE} = 100V$, $R_{BE} = 0$
Collector Capacitance	C_{obo}	—	150	pf	$V_{CB} = 10$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	3	—	—	$I_C = 0.5A$, $V_{CE} = 5V$ $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	—	250	ns	$I_C = 5A$
Switching Speeds — Turn-off Time	t_{off}	—	1.2	μs	$I_{B1} = 500mA$ $I_{B2} = -500mA$

Notes:

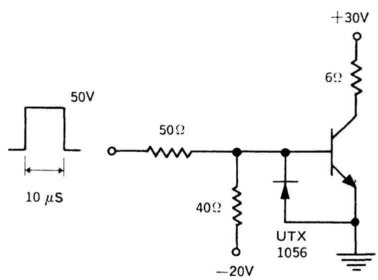
1. The device may be switched between maximum rated collector current and maximum rated collector — emitter voltage along a resistive load line provided the switching time is less than 10 microseconds. Switching at low speed through regions of high instantaneous power dissipation may cause second breakdown to occur, with consequent damage to the device.
2. Pulse length = 300 μs; duty cycle ≤2%.
3. Measured in saturated switching speed circuit.

† All values in this table are JEDEC registered.

Maximum Safe Operating Area



Switching Speed Circuit



UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

POWER TRANSISTORS

8 Amp, 700V, Triple Diffused NPN Mesa

2N6306
2N6307
2N6308

FEATURES

- Collector-Base Voltage: up to 700V
- Peak Collector Current: 16A
- Rise Time: ≤ 600 ns } @ $I_C = 3A$
- Fall Time: ≤ 400 ns } @ $I_C = 3A$

DESCRIPTION

These high voltage triple diffused glass passivated power transistors combine fast switching, low saturation voltage and rugged $E_{S/b}$ capability. They are designed for use in off-line power supplies, high voltage inverters, switching regulators, ignition systems and deflection circuits.

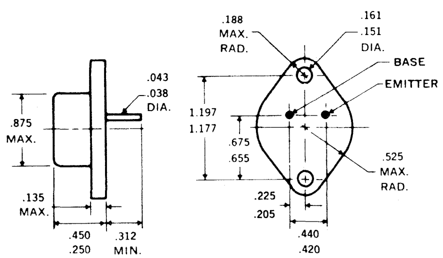
ABSOLUTE MAXIMUM RATINGS *

	2N6306	2N6307	2N6308
Collector-Base Voltage, V_{CBO}	500V	600V	700V
Collector-Emitter Voltage, V_{CEO}	250V	300V	350V
Emitter-Base Voltage, V_{EBO}	8V	8V	8V
Collector Current, I_C continuous	8A	8A	8A
Collector Current, I_{CM} peak	16A	16A	16A
Base Current, I_B continuous	4A	4A	4A
Power Dissipation, P_T 25°C Case	125W	125W	125W
Operating and Storage Temperature Range	−65 to +200°C		

* JEDEC registered values.

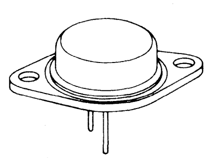
MECHANICAL SPECIFICATIONS

2N6306 2N6307 2N6308



Dimensions in inches.

TO-3



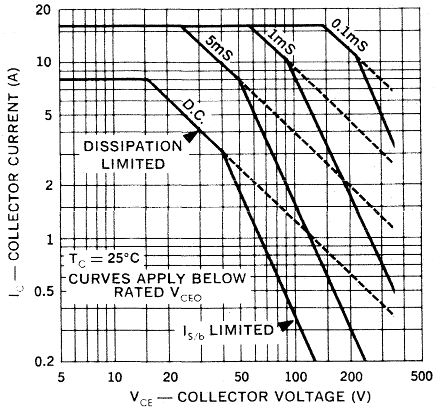
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)*

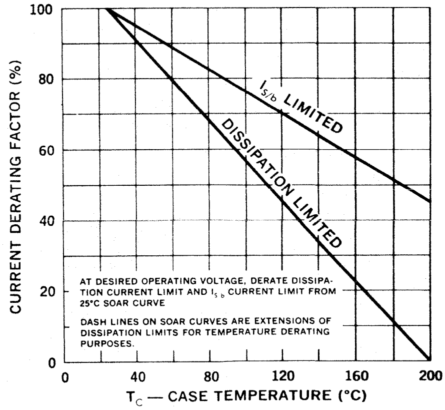
Test	Symbol	2N6306 MIN.	2N6306 MAX.	2N6307 MIN.	2N6307 MAX.	2N6308 MIN.	2N6308 MAX.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	15	75	15	75	12	60		$I_C = 3A, V_{CE} = 5V$
D.C. Current Gain (Note 1)	h_{FE}	4	—	4	—	3	—		$I_C = 8A, V_{CE} = 5V$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	0.8	—	1.0	—	1.5	V	$I_C = 3A, I_B = 0.6A$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	5.0	—	5.0	—	—	V	$I_C = 8A, I_B = 2A$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	—	—	—	—	5.0	V	$I_C = 8A, I_B = 2.67A$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	2.3	—	2.3	—	—	V	$I_C = 8A, I_B = 2A$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	—	—	—	—	2.5	V	$I_C = 8A, I_B = 2.67A$
Base-Emitter Voltage (Note 1)	$V_{BE(on)}$	—	1.3	—	1.3	—	1.5	V	$I_C = 3A, V_{CE} = 5V$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO(SUS)}$	250	—	300	—	350	—	V	$I_C = 100mA, I_B = 0$
Emitter-Base Cutoff Current	I_{EBO}	—	1.0	—	1.0	—	1.0	mA	$V_{EB} = 8V$
Collector Cutoff Current	I_{CEO}	—	0.5	—	—	—	—	mA	$V_{CE} = 250V$
		—	—	—	0.5	—	—		$V_{CE} = 300V$
		—	—	—	—	—	0.5		$V_{CE} = 350V$
Collector Cutoff Current	I_{CEV}	—	0.5	—	—	—	—	mA	$V_{CE} = 500V$, $V_{BE} = -1.5V$
		—	—	—	0.5	—	—		$V_{CE} = 600V$, $V_{BE} = -1.5V$
		—	—	—	—	—	0.5		$V_{CE} = 700V$, $V_{BE} = -1.5V$
Collector Cutoff Current, 150°C	I_{CEV}	—	2.5	—	—	—	—		$V_{CE} = 500V$, $V_{BE} = -1.5V$
		—	—	—	2.5	—	—		$V_{CE} = 600V$, $V_{BE} = -1.5V$
		—	—	—	—	—	2.5		$V_{CE} = 700V$, $V_{BE} = -1.5V$
Second Breakdown Energy	$E_{s/b}$	—	180	—	180	—	180	mJ	$I_C = 3.0A, L = 40 mH$, $R_{BE} = 3K\Omega, V_{BB2} = 1.5V$
Collector Capacitance	C_{ob}	—	250	—	250	—	250	pF	$V_{CB} = 10V, I_E = 0, f = 1 MHz$
Gain-Bandwidth Product	f_T	5	—	5	—	5	—	MHz	$I_C = .3A, V_{CE} = 10V, f = 1 MHz$
Switching Speeds: Rise Time	t_r	—	0.6	—	0.6	—	0.6	μs	$V_{CC} = 125V, I_C = 3A$, $I_{B1} = 0.6A$
Storage Time	t_s	—	1.6	—	1.6	—	1.6	μs	$V_{CC} = 125V, I_C = 3A$, $I_{B1} = 0.6A, I_{B2} = 1.5A$, Pulse Width = 25 μs
Storage Time	t_s	—	0.8	—	0.8	—	0.8	μs	$V_{CC} = 125V, I_C = 3A$, $I_{B1} = 0.6A, I_{B2} = 1.5A$, Pulse Width = 5.0 μs
Fall Time	t_f	—	0.4	—	0.4	—	0.4	μs	$V_{CC} = 125V, I_C = 3A$, $I_{B1} = 0.6A, I_{B2} = 1.5A$
Thermal Resistance	$R\theta_{JC}$	—	1.0	—	1.0	—	1.0	°C/W	

Notes
1. Pulse length = 250 μs; duty cycle ≤1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤1%. Voltage clamped at maximum collector-emitter voltage.
* JEDEC registered values.

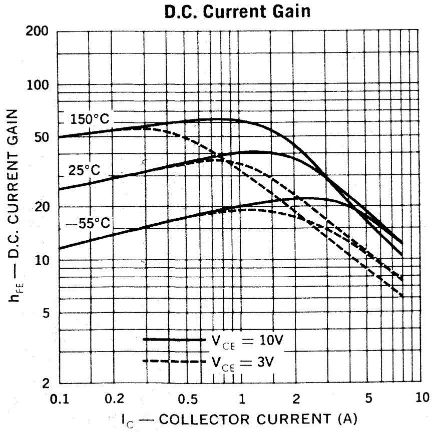
Forward Bias Safe Operating Area



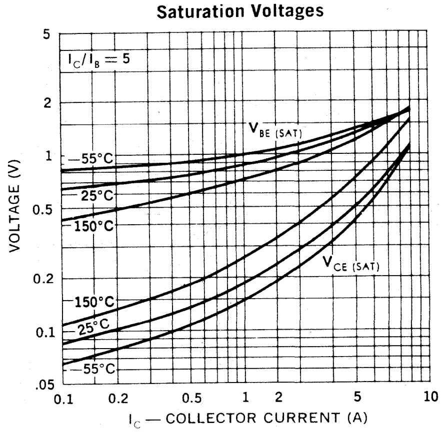
Power Derating



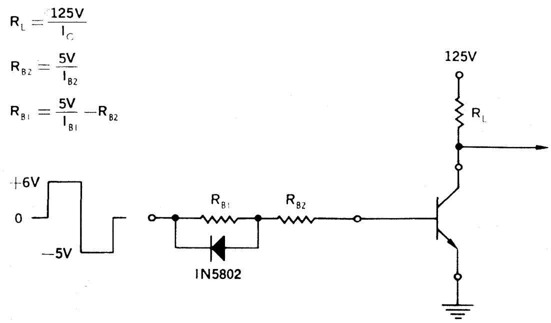
D.C. Current Gain

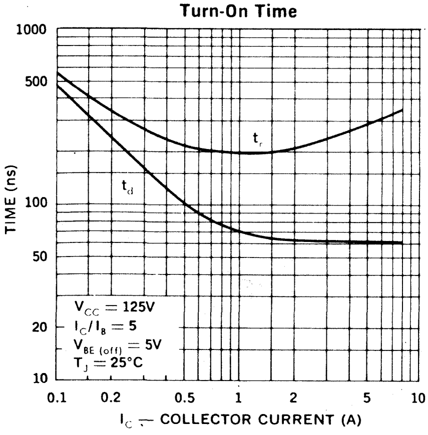


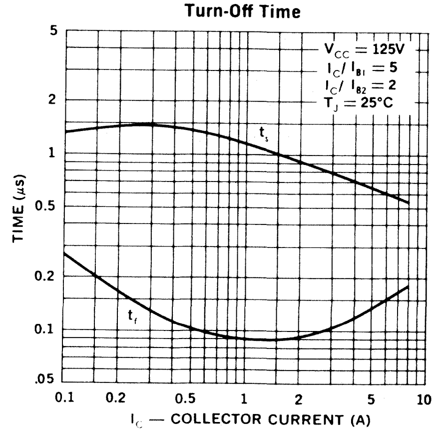
Saturation Voltages



Switching Time Test Circuit







POWER DARLINGTONS

5 Amp, 150V, NPN

JAN & JANTX 2N6350
JAN & JANTX 2N6351
JAN & JANTX 2N6352
JAN & JANTX 2N6353

FEATURES

- High Current Gain: up to 2000 min. @ $I_C = 5A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- Peak Current: to 10A
- JAN/JANTX versions meet MIL-S-19500/472

DESCRIPTION

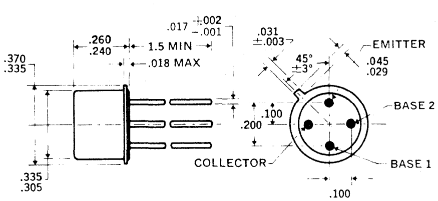
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip. The 2N6350 series is characterized for fast switching applications.

ABSOLUTE MAXIMUM RATINGS

	TO-33		3 PIN TO-66	
	JAN & JANTX 2N6350	JAN & JANTX 2N6351	JAN & JANTX 2N6352	JAN & JANTX 2N6353
Collector — Emitter Voltage	80V	150V	80V	150V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	5W	5W	25W	25W
Thermal Resistance				
Junction-to-Case	20°C/W		4°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

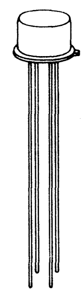
JAN & JANTX 2N6350 JAN & JANTX 2N6351



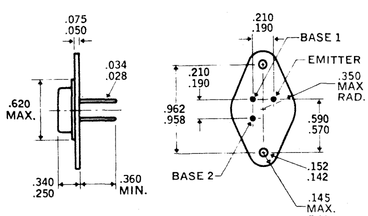
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



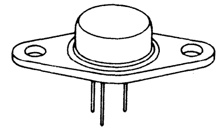
JAN & JANTX 2N6352 JAN & JANTX 2N6353



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66

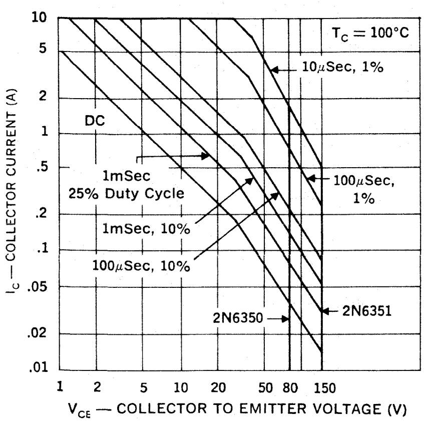


UNITRODE

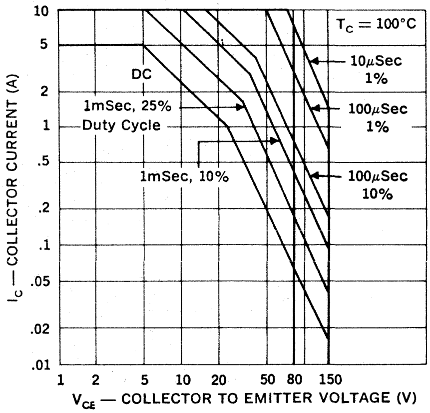
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	MIL-STD-750 Method	MIL-STD-750 Test Conditions
Visual and Mechanical					2071	See Mechanical Data
25°C Collector-Emitter Breakdown Voltage 2N6350, 2N6352 2N6351, 2N6353	BV_{CEO}	 80 150		 Vdc Vdc	3011	$I_C = 25mA$, $R_{BE1} = 2.2K$, $R_{BE2} = 100$ Ohms
Emitter Base Breakdown Voltage, Base 1	BV_{EBO1}	12		Vdc	3026	$I_E = 10$ **mA** Base 1 Open
Emitter Base Breakdown Voltage, Base 2	BV_{EBO2}	6		Vdc	3026	$I_E = 10$ **mA** Base 2 Open
Collector — Emitter Cutoff Current	I_{CEX}		1.0	μAdc	3041	$V_{CE} = BV_{CEO}$ Rating
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 2000 1000			3076	$V_{CE} = 5Vdc$; $I_C = 1.0A$ (pulse) $R_{BE2} = 1K$
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 2000 1000	 10000 10000		3076	$V_{CE} = 5Vdc$; $I_C = 5.0Adc$ (pulse) $R_{BE2} = 100$ Ohms
D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 400 200			3076	$V_{CE} = 5Vdc$; $I_C = 10Adc$ (pulse) $R_{BE2} = 100$ Ohms
Collector Saturation Voltage 2N6350, 2N6352 2N6351, 2N6353	V_{CE} (sat)		 1.5 1.5	 Vdc Vdc	3071	$I_C = 5.0Adc$, $R_{BE2} = 100$ Ohms $I_{B1} = 5mAdc$ (pulse) $I_{B1} = 10mAdc$ (pulse)
Base Saturation Voltage	V_{BE1} (on)		2.5	Vdc	3066	$I_C = 5.0Adc$ (pulse), $V_{CE} = 5Vdc$ $R_{BE2} = 100$ Ohms
A.C. Current Gain	$\|h_{FE}\|$	5	25		3066	$V_{CE} = 10Vdc$, $I_C = 1.0Adc$, $f = 10MHz$ $R_{BE2} = 100$ Ohms
Output Capacitance	C_{OBO1}		40	pf	3236	$V_{CB1} = 10Vdc$, $100KHz \leqslant f \leqslant 1MHz$ Base 2 open
Turn-on Time	t_{on}		0.5	μs	3251	$V_{CC} = 30Vdc$; $I_C = 5.0Adc$ See Switching Speed Circuit
Turn-off Time	t_{off}		1.2	μs	3251	$V_{CC} = 30Vdc$; $I_C = 5.0Adc$ See Switching Speed Circuit
150°C Collector-Emitter Cutoff Current	I_{CEX}		1.0	μAdc	3041	$V_{EB1} = 2Vdc$, $R_{BE2} = 100$ Ohms $V_{CE} = BV_{CEO}$ Rating
—65°C D.C. Current Gain 2N6350, 2N6352 2N6351, 2N6353	h_{FE}	 400 200			3076	$V_{CE} = 5Vdc$, $I_C = 5.0Adc$ (pulse) $R_{BE2} = 100$ Ohms

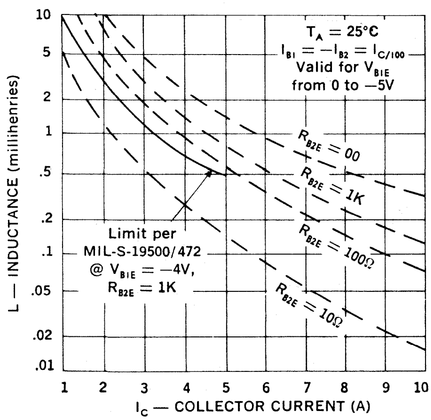
Forward Bias Safe Operating Area 2N6350, 2N6351



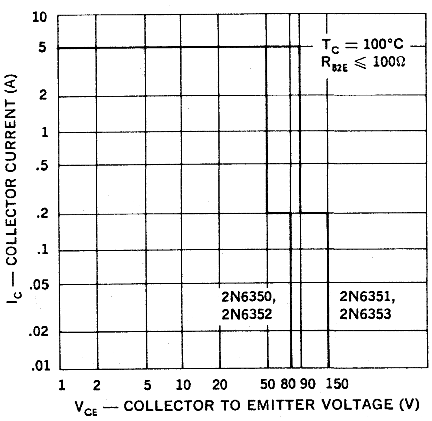
Forward Bias Safe Operating Area 2N6352, 2N6353



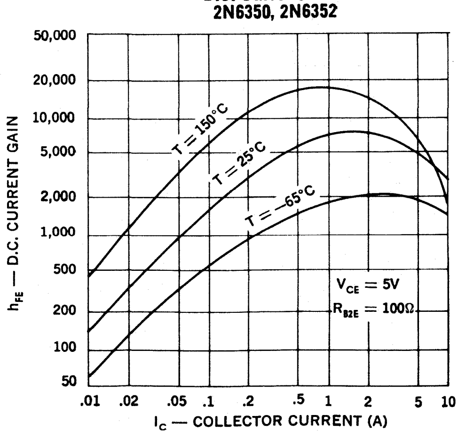
Unclamped Reverse Bias Second Breakdown



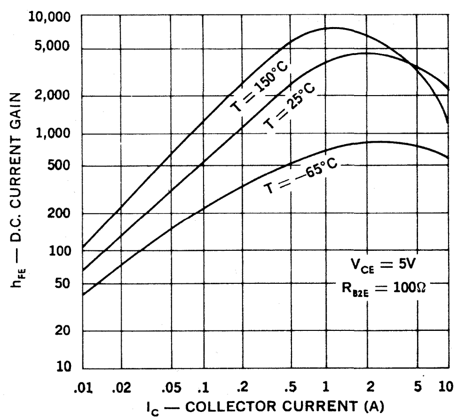
Reverse Bias Safe Operating Area Clamped Inductive Switching



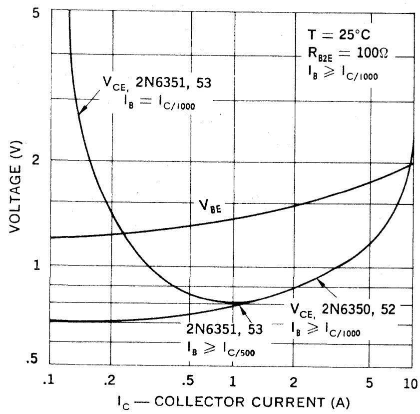
D.C. Current Gain 2N6350, 2N6352



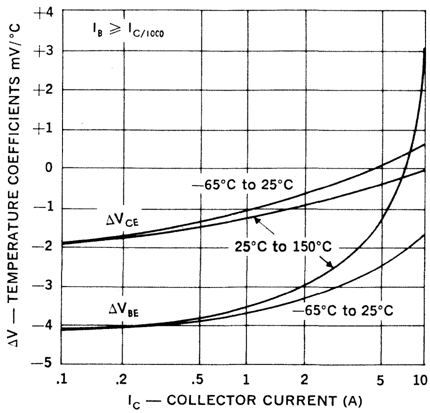
D.C. Current Gain 2N6351, 2N6353



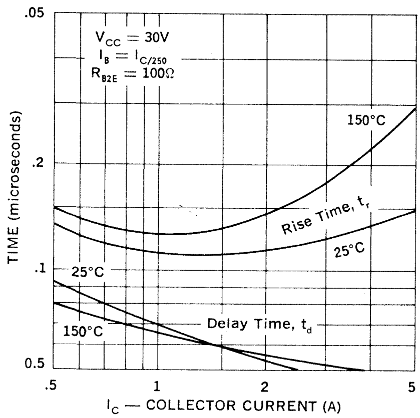
Saturation Voltages



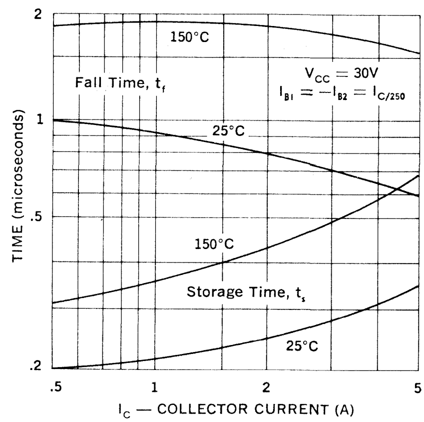
Saturation Voltage Temperature Coefficients



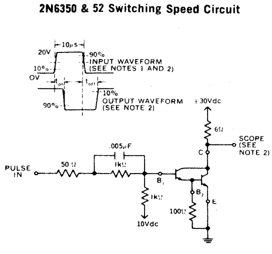
Switching Speed Characteristics



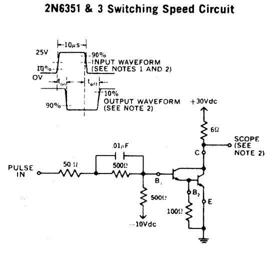
Switching Speed Characteristics



2N6350 & 52 Switching Speed Circuit

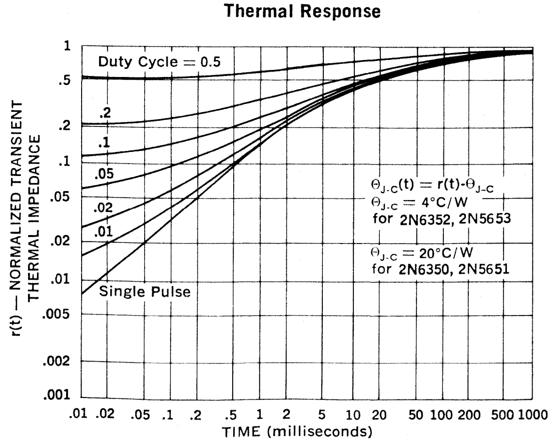


2N6351 & 3 Switching Speed Circuit



NOTES:
1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\Omega$, PW = 10 μs, Duty cycle ≤ 2%.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $Z_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
3. Resistors shall be noninductive types.
4. The DC power supplies may require additional by-passing in order to minimize ringing.

Thermal Response



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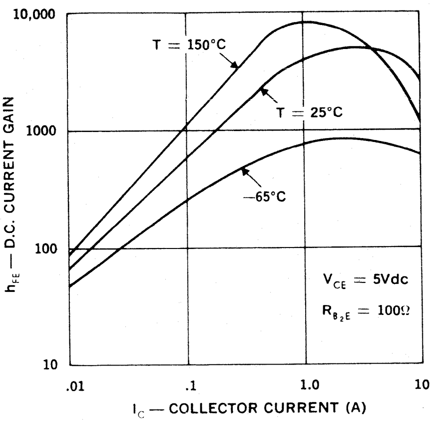
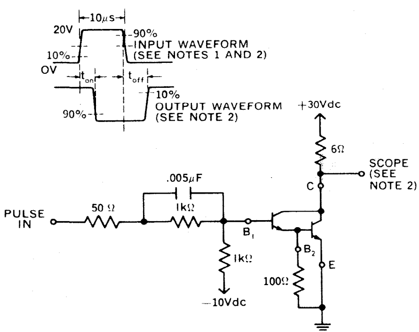
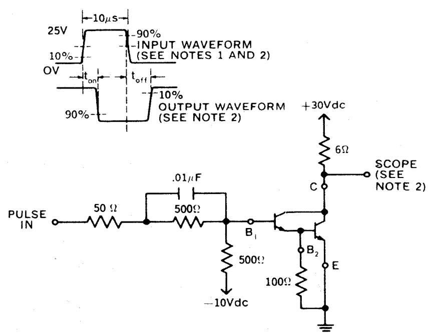
D.C. Current Gain vs. Collector Current
2N6350 — 2N6353



2N6350 & 52 Switching Speed Circuit



2N6351 & 3 Switching Speed Circuit



NOTES:
1. The input waveform is supplied by a pulse generator with the following characteristics: $t_r \leq 15$ ns, $t_f \leq 15$ ns, $Z_{out} = 50\Omega$, PW = 10 μs, Duty cycle ≤ 2%.
2. Output waveforms are monitored on an oscilloscope with the following characteristics: $t_r \leq 15$ ns, $Z_{in} \geq 10$ MΩ, $C_{in} \leq 11.5$ pF.
3. Resistors shall be noninductive types.
4. The DC power supplies may require additional by-passing in order to minimize ringing.

POWER TRANSISTORS

7 Amp, 400V, Triple Diffused NPN Mesa

2N6510
2N6511
2N6512
2N6513
2N6514

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 10A
- Rise Time: $\leqslant 1.5\mu s$ } @ $I_C = 4A$
- Fall Time: $\leqslant 1.5\mu s$ } @ $I_C = 4A$

DESCRIPTION

These high voltage triple diffused glass passivated power transistors combine fast switching, low saturation voltage and rugged $E_{S/b}$ capability. They are designed for use in off-line power supplies, high voltage inverters, switching regulators, ignition systems and deflection circuits.

ABSOLUTE MAXIMUM RATINGS

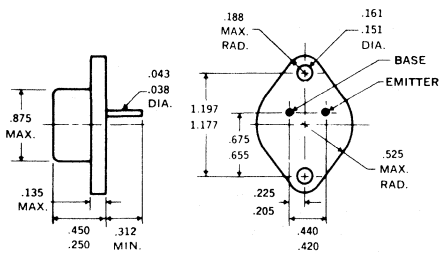
	2N6510	2N6511	2N6512	2N6513	2N6514
*Collector Base Voltage, V_{CPO}	250V	300V	350V	400V	350V
Collector-Emitter Sustaining Voltage, $V_{CER\ (sus)}$ (1)	250V	300V	350V	400V	350V
*Collector-Emitter Sustaining Voltage, $V_{CEO\ (sus)}$	200V	250V	300V	350V	300V
*Emitter-Base Voltage, V_{EBO}	6V	6V	6V	6V	6V
*Collector Current, I_C continuous	7A	7A	7A	7A	7A
*Base Current, I_B	10A	10A	10A	10A	10A
*Emitter Current, I_E	3A	3A	3A	3A	3A
*Power Dissipation, P_T 25°C Case	120W	120W	120W	120W	120W
*Operating and Storage Temperature Range	–65 to +200°C				

(1) $R_{BE} = 50\Omega$

*JEDEC registered values

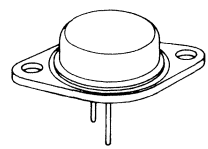
MECHANICAL SPECIFICATIONS

2N6510 2N6511 2N6512 2N6513 2N6514



Dimensions in inches.

TO-3



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	2N6510 Min.	2N6510 Max.	2N6514 Min.	2N6514 Max.	Units	Test Conditions
*D.C. Current Gain (Note 1)	h_{FE}	10	50	—	—		$I_C = 3A, V_{CE} = 3V$
		—	—	10	50		$I_C = 5A, V_{CE} = 3V$
*Collector Saturation Voltage (Note 1)	$V_{CE\,(sat)}$	—	1.5	—	—	V	$I_C = 3A, I_B = 0.6A$
		—	—	—	1.5	V	$I_C = 5A, I_B = 1A$
		—	2.5	—	2.5	V	$I_C = 7A, I_B = 3A$
*Base Saturation Voltage (Note 1)	$V_{BE\,(sat)}$	—	1.7	—	—	V	$I_C = 3A, I_B = 0.6A$
		—	—	—	1.7	V	$I_C = 5A, I_B = 1A$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO\,(sus)}$	200 *	—	300 *	—	V	$I_C = 0.2A$
	$V_{CER\,(sus)}$	250	—	350	—	V	$I_C = 0.2A, R_{BE} = 50\Omega$
*Collector Cutoff Current	I_{CEV}	—	5.0	—	—	mA	$V_{CE} = 250V, V_{BE} = -1.5V$
		—	—	—	5.0	mA	$V_{CE} = 350V, V_{BE} = -1.5V$
*Collector Cutoff Current 100°C	I_{CEV}	—	10	—	—	mA	$V_{CE} = 250V, V_{BE} = -1.5V$
		—	—	—	10	mA	$V_{CE} = 350V, V_{BE} = -1.5V$
*Switching Speeds							
Delay Time	t_d	—	0.2	—	—	μs	$V_{CC} = 200V$, $I_C = 3A$, $I_{B1} = I_{B2} = 0.6A$
Rise Time	t_r	—	1.5	—	—	μs	
Storage Time	t_s	—	5.0	—	—	μs	
Fall Time	t_f	—	1.5	—	—	μs	
Delay Time	t_d	—	—	—	0.2	μs	$V_{CC} = 200V$, $I_C = 5A$, $I_{B1} = I_{B2} = 1A$
Rise Time	t_r	—	—	—	1.5	μs	
Storage Time	t_s	—	—	—	5.0	μs	
Fall Time	t_f	—	—	—	1.5	μs	

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	2N6511 Min.	2N6511 Max.	2N6512 Min.	2N6512 Max.	2N6513 Min.	2N6513 Max.	Units	Test Conditions
*D.C. Current Gain (Note 1)	h_{FE}	10	50	10	50	10	50		$I_C = 4A, V_{CE} = 3V$
*Collector Saturation Voltage (Note 1)	$V_{CE\,(sat)}$	—	1.5	—	1.5	—	1.5	V	$I_C = 4A, I_B = 0.8A$
		—	2.5	—	2.5	—	2.5	V	$I_C = 7A, I_B = 3A$
*Base Saturation Voltage (Note 1)	$V_{BE\,(sat)}$	—	1.7	—	1.7	—	1.7	V	$I_C = 4A, I_B = 0.8A$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO\,(sus)}$	250	—	300	—	350	—	V	$I_C = 0.2A$
	$V_{CER\,(sus)}$	300	—	350	—	400	—	V	$I_C = 0.2A, R_{BE} = 50\Omega$
*Collector Cutoff Current	I_{CEV}	—	5.0	—	—	—	—	mA	$V_{CE} = 300V, V_{BE} = -1.5V$
		—	—	—	5.0	—	—	mA	$V_{CE} = 350V, V_{BE} = -1.5V$
		—	—	—	—	—	5.0	mA	$V_{CE} = 400V, V_{BE} = -1.5V$
*Collector Cutoff Current, 100°C	I_{CEV}	—	10	—	—	—	—	mA	$V_{CE} = 300V, V_{BE} = -1.5V$
		—	—	—	10	—	—	mA	$V_{CE} = 300V, V_{BE} = -1.5V$
		—	—	—	—	—	10	mA	$V_{CE} = 400V, V_{BE} = -1.5V$
*Switching Speeds									
Delay Time	t_d	—	0.2	—	0.2	—	0.2	μs	$V_{CC} = 200V$, $I_C = 4A$, $I_{B1} = I_{B2} = 0.8A$
Rise Time	t_r	—	1.5	—	1.5	—	1.5	μs	
Storage Time	t_s	—	5.0	—	5.0	—	5.0	μs	
Fall Time	t_f	—	1.5	—	1.5	—	1.5	μs	

Notes

1. Pulse length = 250 μs; duty cycle ≤1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤1%. Voltage clamped at maximum collector-emitter voltage.

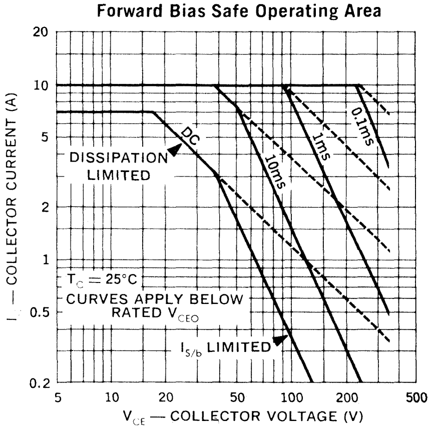
* JEDEC registered values.

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)*

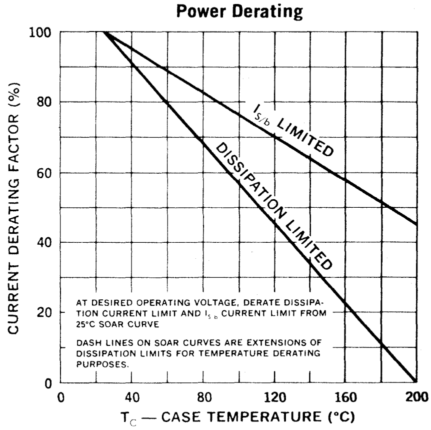
Test	Symbol	All Types Min.	All Types Max.	Units	Test Conditions
Emitter-Base Cutoff Current	I_{EBO}	—	3.0	mA	$V_{EB} = 6V$
Magnitude of Common Emitter Small-Signal Short Circuit Forward Current Transfer Ratio	$\lvert h_{fe} \rvert$	3	9		$I_C = 1A$ $V_{CE} = 10V$ $f = 1MHz$
Forward-Bias Second Breakdown	$I_{S/b}$	3.16	—	A	$V_{CE} = 35V$, $t = 1s$, non-rep.
Collector Current		0.1	—	A	$V_{CE} = 200V$, $t = 1s$, non-rep.
Collector Capacitance	C_{ob}	100	200	pF	$V_{CB} = 10V$, $f = 1MHz$
Thermal Resistance, Junction-to-Case	$R\theta_{JC}$	—	1.46	°C/W	$V_{CE} = 20V$, $I_C = 5A$

* All values in this table are JEDEC registered.

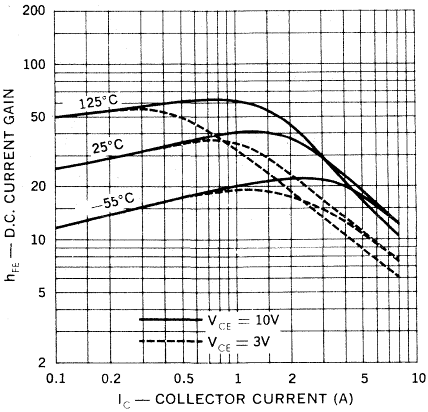
Forward Bias Safe Operating Area



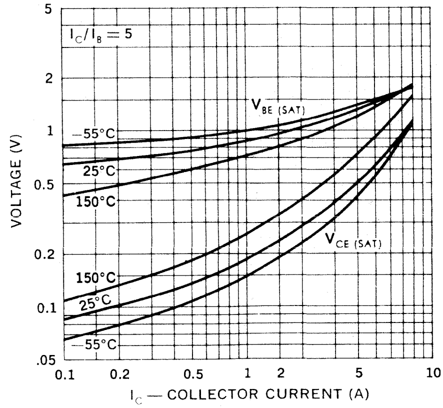
Power Derating



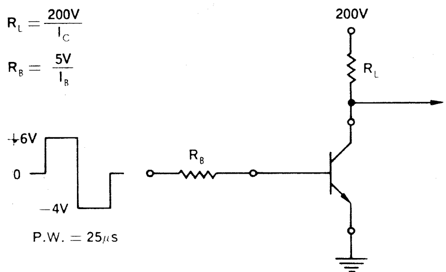
D.C. Current Gain



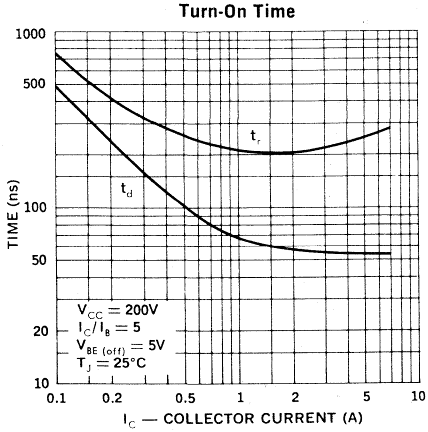
Saturation Voltages



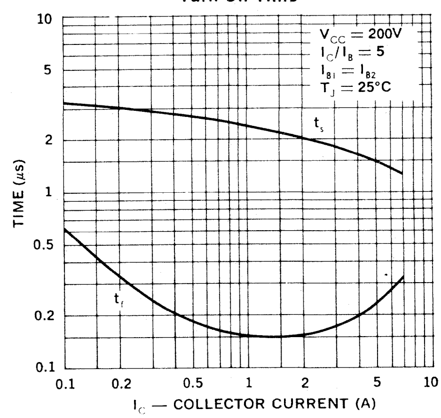
Switching Time Test Circuit



Turn-On Time



Turn-Off Time



POWER TRANSISTORS

8 Amp, 850V, Triple Diffused, NPN, Mesa

2N6544
2N6545

FEATURES

- Collector-Base Voltage: up to 850V
- Peak Collector Current: 16A
- Rise Time: $\leqslant 1.0\mu s$ } @ $I_C = 5A$
- Fall Time: $\leqslant 1.0\mu s$ } @ $I_C = 5A$
- Key Parameters characterized at 100°C

DESCRIPTION

These high voltage triple diffused glass passivated power transistors combine fast switching, low saturation voltage and rugged $E_{S/b}$ capability. They are designed for use in off-line power supplies, high voltage inverters, switching regulators, ignition systems and deflection circuits.

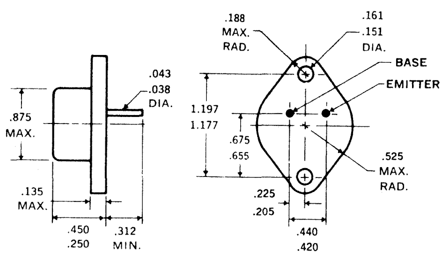
ABSOLUTE MAXIMUM RATINGS *

	2N6544	2N6545
Collector-Base Voltage, V_{CBO}	650V	850V
Collector-Emitter Voltage, $V_{CEO\,(SUS)}$	300V	400V
Emitter-Base Voltage, V_{EBO}	9V	9V
Collector Current, I_C, continuous	8A	8A
Base Current, I_B, continuous	8A	8A
Emitter Current, I_E, continuous	16A	16A
Power Dissipation, 25°C Case	125W	125W
Derating Factor	.714W/°C	.714W/°C
Operating and Storage Temperature Range	−65 to 200°C	

* JEDEC registered values.

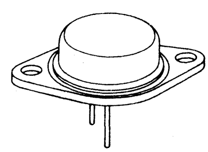
MECHANICAL SPECIFICATIONS

2N6544 2N6545



Dimensions in inches.

TO-3



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)*

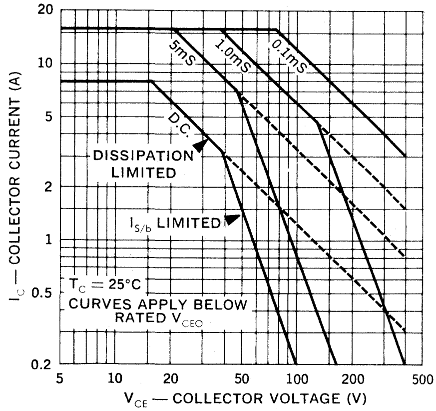
Test	Symbol	2N6544 MIN.	2N6544 MAX.	2N6545 MIN.	2N6545 MAX.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	12	60	12	60		$I_C = 2.5A, V_{CE} = 3V$
D.C. Current Gain (Note 1)	h_{FE}	7	35	7	35		$I_C = 5.0A, V_{CE} = 3V$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	1.5	—	1.5	V	$I_C = 5.0A, I_B = 1.0A$
Collector Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{CE(sat)}$	—	2.5	—	2.5	V	$I_C = 5.0A, I_B = 1.0A$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	5.0	—	5.0	V	$I_C = 8.0A, I_B = 2.0A$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	1.6	—	1.6	V	$I_C = 5.0A, I_B = 1.0A$
Base Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{BE(sat)}$	—	1.6	—	1.6	V	$I_C = 5.0A, I_B = 1.0A$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO(sus)}$	300	—	400	—	V	$I_C = 0.1A$
Collector-Emitter Sustaining Voltage $T_C = 100°C$ (Note 2)	$V_{CEX(sus)}$	350	—	450	—		$L = 180\mu H, I_C = 4.5A$ $V_{BE} = -5V$ V_{CE} clamped to rated $V_{CEX(sus)}$
Emitter-Base Cutoff Current	I_{EBO}	—	1	—	1	mA	$V_{EB} = 9V$
Collector Cutoff Current	I_{CEV}	—	0.5	—	—	mA	$V_{CE} = 650V, V_{BE} = -1.5V$
		—	—	—	0.5		$V_{CE} = 850V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CEV}	—	2.5	—	—	mA	$V_{CE} = 650V, V_{BE} = -1.5V$
		—	—	—	2.5		$V_{CE} = 850V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CER}	—	3.0	—	—	mA	$V_{CE} = 650V, R = 50\Omega$
		—	—	—	3.0		$V_{CE} = 850V, R = 50\Omega$
Output Capacitance, Common Base	C_{obo}	100	200	100	200	pF	$V_{CB} = 10V, f = 1$ MHz
Gain-Bandwidth Product	F_T	6	24	6	24	MHz	$V_{CE} = 10V, I_C = 0.3A, f = 1$ MHz
Energy Second Breakdown (unclamped)	$E_{s/b}$	500	—	500	—	μJ	$I_C = 5.0A$ $I_B = 1.0A$ $L = 40\mu H$
Resistive Switching Speeds						μs	$I_C = 5.0A$ $V_{CC} = 125V$ $I_{B1} = I_{B2} = 1.0A$ $V_{BE(off)} = 5V$
Delay Time	t_d	—	0.05	—	0.05		
Rise Time	t_r	—	1.0	—	1.0		
Storage Time	t_s	—	4.0	—	4.0		
Fall Time	t_f	—	1.0	—	1.0		
Inductive Switching Speeds $T_C = 100°C$						μs	$I_C = 5.0A$ $I_B = 1.0A$ $V_{BE(off)} = 5V$ V_{CE} clamp = rated $V_{CEX(sus)}$
Storage Time	t_s	—	4.0	—	4.0		
Fall Time	t_f	—	0.9	—	0.9		
Thermal Resistance, Junction-to-Case	$R_{\theta JC}$	—	1.4	—	1.4	°C/W	

Notes

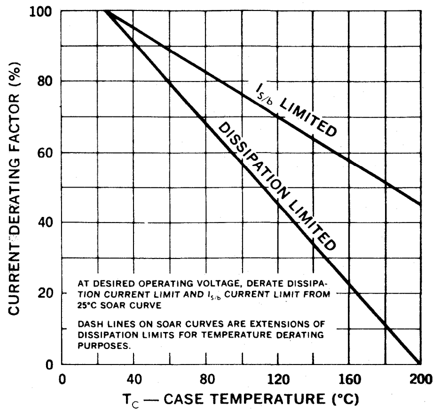
1. Pulse length = 250 μs; duty cycle ≤1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤1%. Voltage clamped at maximum collector-emitter voltage.

* JEDEC registered values.

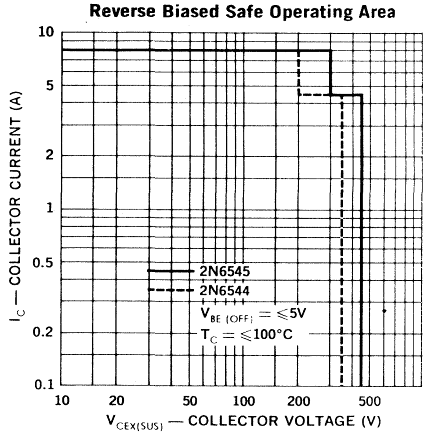
Forward Bias Safe Operating Area



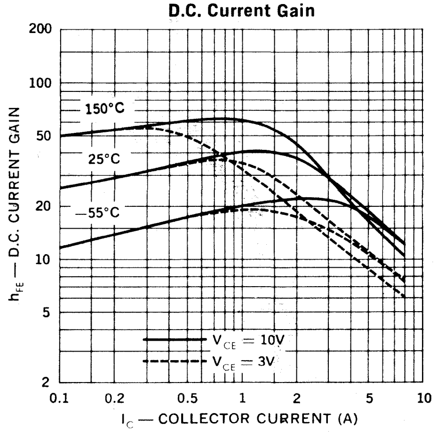
Power Derating



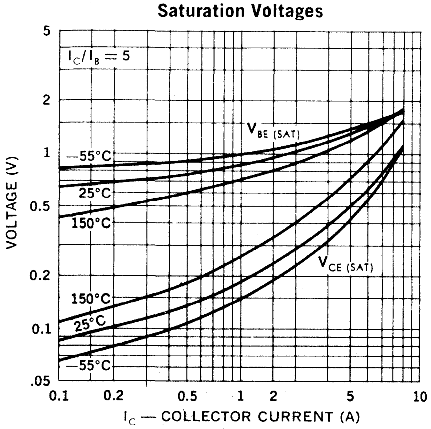
Reverse Biased Safe Operating Area



D.C. Current Gain



Saturation Voltages

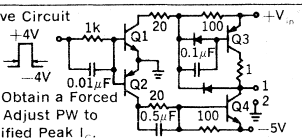
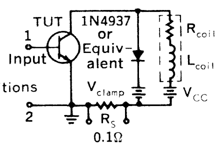
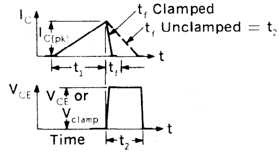
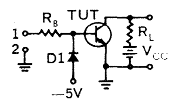


Inductive Load Switching Performance

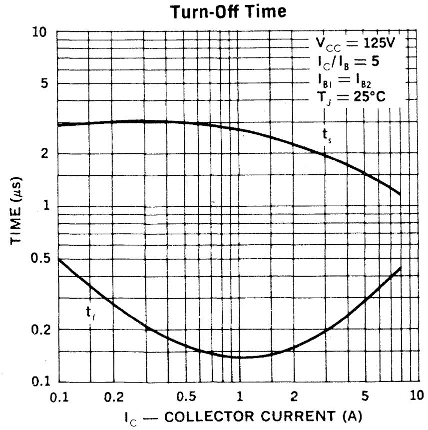
I_C Amps	T_J °C	t_s µs	t_{fv} µs	t_{fi} µs
3.0	25	.90	.07	.07
	100	1.40	.12	.15
5.0	25	.98	.10	.11
	100	1.52	.15	.20
8.0	25	1.10	.14	.11
	100	1.70	.20	.18

t_{fv} = voltage fall time; 10-90%
t_{fi} = current fall time; 10-90%

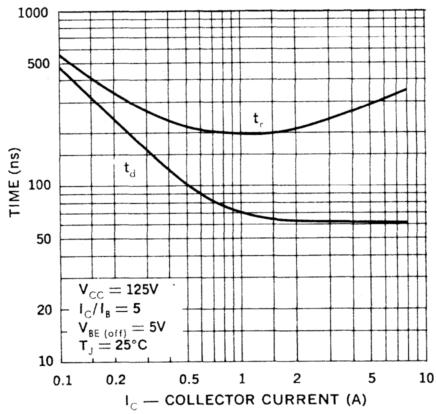
TEST CONDITIONS FOR DYNAMIC PERFORMANCE

	$V_{CEO(SUS)}$	$V_{CEX(SUS)}$ AND INDUCTIVE SWITCHING	$E_{S/b}$	RESISTIVE SWITCHING
INPUT CONDITIONS	+10V, 20Ω, 0; PW Varied to Attain I_C = 100mA	Drive Circuit  Set $+V_{in}$ to Obtain a Forced h_{FE} = 5 and Adjust PW to Attain Specified Peak I_C. Duty Cycle ≤ 3%, f = 1kHz; Q1 2N6408, Q2 2N6406, Q3 2N5875, Q4 2N5877, Diodes 1N4933	I_{B1} = 1A, +22.5V, 15Ω, 10Ω, 4V; PW Varied to Attain I_C	≈ +13V, ≈ −11V; I_C = 5A, PW ≤ 100μs, t_r ≤ 5ns, t_f ≤ 50ns, Duty Cyle ≤ 2%
CIRCUIT VALUES	L_{coil} = 80mH, V_{CC} = 10V, R_{coil} = 0.7Ω, V_{clamp} (Unclamped)	L_{coil} = 180μH, R_{coil} = 0.05Ω, V_{CC} = 20V, f_o = 500kHz; V_{clamp} = Rated V_{CEX} Value	L_{coil} = 40μH, V_{CC} = 10V, R_{coil} = 0.2Ω, V_{clamp} (Unclamped)	V_{CC} = 125V, R_L = 25Ω, D1 = 1N5820 or Equiv., R_B = 12Ω
TEST CIRCUITS	INDUCTIVE TEST CIRCUIT  See Above For Detailed Conditions	OUTPUT WAVEFORMS 	t_1 Adjusted to Obtain I_C; $t_1 \approx \frac{L_{coil}(I_{Cpk})}{V_{CC}}$; $t_2 \approx \frac{L_{coil}(I_{Cpk})}{V_{clamp}}$; Test Equipment Tektronix Scope 475 or Equivalent	RESISTIVE TEST CIRCUIT 

Turn-Off Time



Turn-On Time



SCRs

.8 Amp RMS, Plastic

2N6564-2N6565

FEATURES

- Voltage Ratings: to 400V
- Forward Current: 0.8A RMS
- Surge Current: 6A, 8ms
- Gate Sensitivity: 200μa max.
- Planar Passivated Process
- TO-92 Plastic Package

DESCRIPTION

This plastic series features very fast switching performance, low forward voltage drop and a high degree of reliability and parameter stability. All units are fully planar passivated and are packaged in a rugged TO-92 case, constructed from a special epoxy compound that features excellent moisture resistance providing stable performance under high humidity conditions and good thermal transfer characteristics.

TYPICAL APPLICATIONS

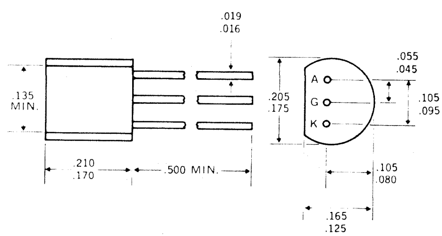
Lamp Driving	Process Controls	Remote Controls
Relay Driving	Pressure Controls	High Current SCR Driving
Relay Replacement	Display Systems	Timers
Alarm Systems	Touch Switches	Temperature Controls
Counters	and many other current sensing and control applications.	

ABSOLUTE MAXIMUM RATINGS

	2N6564	2N6565
Repetitive Peak Off-State Voltage, V_{DRM}	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	300V	400V
On-State Current, $I_{T(RMS)}$ @ $T_C = 70°C$	0.8A	
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	6A	
Peak Gate Current, I_{GM}	1.0A	
Peak Gate Power, P_{GM}	1W	
Average Gate Power $P_{G(AV)}$	0.01W	
Reverse Gate Voltage, V_{GR}	6V	
Storage Temperature Range	−65°C to +150°C	
Operating Temperature Range	−65°C to +125°C	

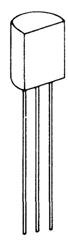
MECHANICAL SPECIFICATIONS

2N6564-2N6565



Dimensions in inches.

TO92



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted, R_{GK} = 1000 ohms)

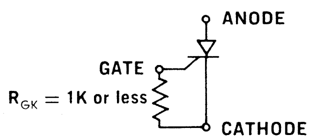
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	— —	0.1 —	1.0 100	μA μA	V_{DRM} = Rating V_{DRM} = Rating, T = 125°C*
Reverse Current	I_{RRM}	— —	0.1 —	1.0 100	μA μA	V_{RRM} = Rating V_{RRM} = Rating, T = 125°C*
Gate Trigger Current	I_{GT}	— —	— —	200 350	μA μA	V_D = 6V, R_L = 100 ohms V_D = 6V, R_L = 100 ohms, T = —65°C*
Gate Trigger Voltage	V_{GT}	— — 0.1	0.6 — —	0.8 1.2 —	V V V	V_D = 6V, R_L = 100 ohms V_D = 6V, R_L = 100 ohms, T = —65°C* V_D = Rating, R_L = 100 ohms, T = 125°C*
Peak On-State Voltage	V_{TM}	—	1.0	1.7	V	I_{TM} = 1.2 Amp Pulse*
Holding Current	I_H	— —	0.7 —	5.0 10.0	mA mA	V_D = 6V, T = 25°C V_D = 6V, T = —65°C*
Critical Rate of Rise — Off-State Voltage	dv/dt	—	75	—	V/μs	V_D = Rating
Turn-on Time	t_{on}	—	0.5	1.5	μs	I_G = 10mA, I_T = 1A, V_D = Rating*
Circuit Commutated Turn-off Time	t_q	—	15	—	μs	I_T = I_R = 1A

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

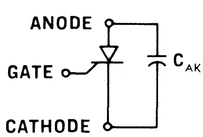
*Indicates JEDEC Registered data.

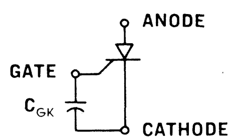
DESIGN CONSIDERATIONS

1. The 2N6564 Series SCRs are guaranteed to block their rated voltage over the rated operating temperature when a resistance of 1000 ohms or less is connected from gate to cathode as shown.



2. In cases where the SCR may be subjected to fast rising anode voltages a capacitor can be connected between anode or gate and cathode as shown, to serve as protection against dv/dt firing.





SCRs
1.0 Amp. RMS, Plastic 800V

2N6681
2N6682
2N6683
2N6684
2N6685

FEATURES:
- Forward Current: 1.0A RMS
- Voltage Ratings: to 800V
- High Surge Current: 15A, 8mS
- Gate Sensitivity: 30μA Typical
- Hard Glass Passivated Junction
- Economical TO-92 Package

TYPICAL APPLICATIONS:

Ground fault interrupters
Photo flash circuits
Ignition/Ignitor circuits
Relay drivers
Relay replacement
Gate drivers for high current SCRs
Lamp driving
Off-line appliance controls

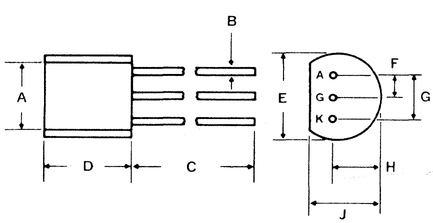
DESCRIPTION:
This plastic PNPN device is rated at 1.0 Amp RMS maximum on-state current, with rated voltages up to 800 volts. All units in this series offer full hard glass passivation with sensitivity especially targeted for good transient immunity. Supplied in an economical TO-92 package, this device is well suited for many high volume applications.

MAXIMUM RATINGS

	2N6681	2N6682	2N6683	2N6684	2N6685
Repetitive Peak Off-State Voltage, V_{DRM}	100V	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	100V	200V	400V	600V	800V
On-State Current, I_T RMS At 60°C Case, 180° Conduction Sinewave			1.0A		
Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			1.0A		
Peak Gate Power, P_{GM}			1W		
Average Gate Power P_G (AV.)			0.01W		
Reverse Gate Voltage, V_{GR}			6V		
Storage Temperature Range			−55°C to +150°C		
Operating Temperature Range			−55°C to +110°C		

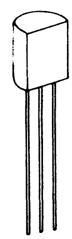
MECHANICAL SPECIFICATIONS

2N6681-5 SERIES



	inches	millimeters
A	.135 MIN.	3.43 MIN.
B	.019 - .016	.48 - .41
D	.210 - .170	5.33 - 4.32
C	.500 MIN.	12.7 MIN.
E	.205 - .175	5.21 - 4.45
J	.165 - .125	4.19 - 3.18
F	.055 - .045	1.40 - 1.14
G	.105 - .095	2.67 - 2.41
H	.105 - .080	2.67 - 2.03

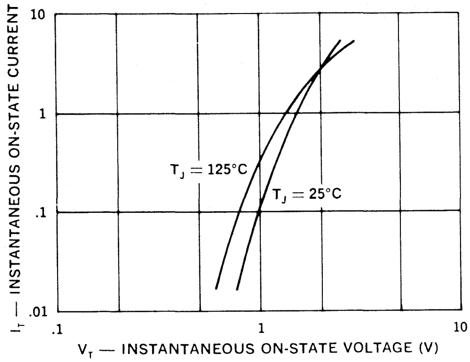
TO-92



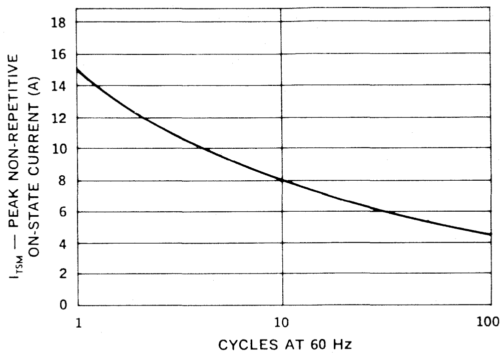
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 110°C
Reverse Current	I_{RRM}	—	—	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 110°C
Gate Trigger Current	I_{GT}	—	30	200	μA	V_D = 6V, R_{GS} = 10K
Gate Trigger Voltage	V_{GT}	—	0.6	0.8	V	V_D = 6V, R_{GS} = 100Ω
		—	—	1.2	V	V_D = 6V, R_{GS} = 100Ω, T = − 55°C
		0.1	—	—	V	V_D = 6V, R_{GS} = 100Ω, T = 125°C
Peak On-State Voltage	V_{TM}	—	—	1.5	V	I_{TM} = 1 Amp Pulse
Holding Current	I_{HX}	—	0.7	5.0	mA	R_{GK} = 1K, T = 25°C
		—	—	10.0	mA	R_{GK} = 1K, T = −55°C
Critical Rate of Rise — Off-State Voltage	dv/dt	—	20	—	V/μs	V_D = Rating, R_{GK} = 1K, T = 100°C

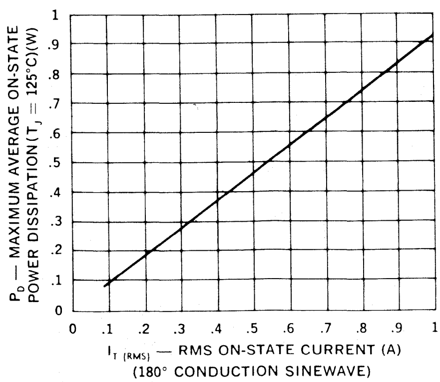
Maximum On-State Characteristics



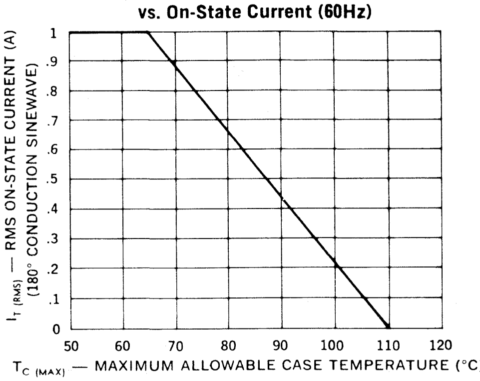
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum On-State Power Dissipation (60Hz)



Maximum Allowable Case Temperature vs. On-State Current (60Hz)



RECTIFIER ASSEMBLIES

Single Phase Bridges, 10 Amp, Military Approved

JAN & JANTX 469-1
JAN & JANTX 469-2
JAN & JANTX 469-3

FEATURES

- Qualified to MIL-S-19500/469
- Current Rating: to 10A
- PIV: from 200 to 600V
- Surge Ratings: to 100A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

This series of military high-current single-phase bridge offer the utmost in reliability as required in military system designs. The TX series is assembled with diodes which have been subjected to 100% screening tests.

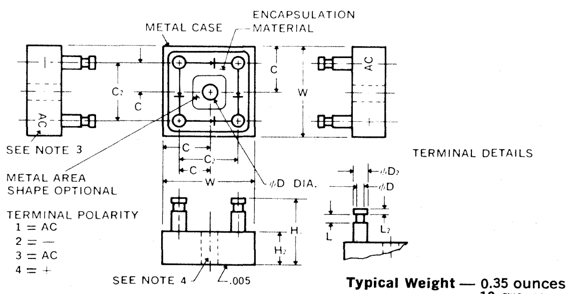
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	200 to 600V
Maximum Average D.C. Output Current	
@ $T_C = +55°C$	10A
@ $T_C = +100°C$	6A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_C = +55°C$	100A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	5°C/W

Dimensions				
Ltr	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
C_1	.367	.375	9.32	9.53
C_2	.350	.450	8.89	11.43
C_3	.175	.225	4.45	5.72
ϕD_1	.139	.149	3.53	3.78
ϕD_2	.091	.101	2.31	2.57
ϕD_3	.066	.076	1.68	1.93
H_1		.570		14.48
H_2		.370		9.40
L_1	.088	.098	2.24	2.49
L_2	.020	.030	.51	.76
W	.735	.750	18.67	19.05

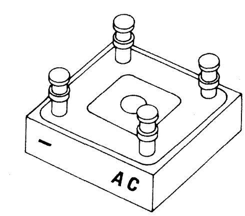
MECHANICAL SPECIFICATIONS

JAN & JANTX 469-1, JAN & JANTX 469-2, JAN & JANTX 469-3



See table above

Typical Weight — 0.35 ounces
10 grams



NOTES:

1. Metric equivalents (to the nearest .01 mm) are given for general information only and are based upon 1 inch = 25.4 mm.
2. Terminals shall be tinned.
3. Polarity shall be marked on the bridge body adjacent to terminals. Terminal numbers are for reference and do not have to be marked on the bridge; however, terminal (1) shall be indicated by a mechanical index such as a line, flattened corner, etc., visible from the top (terminal surface) of the device.
4. Point at which T_C is read shall be in metal part of a case as shown on drawing.

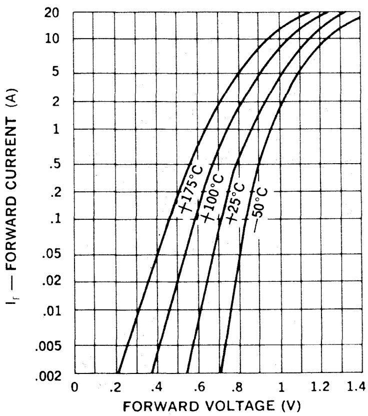
UNITRODE

Electrical Specification (at 25°C unless noted)

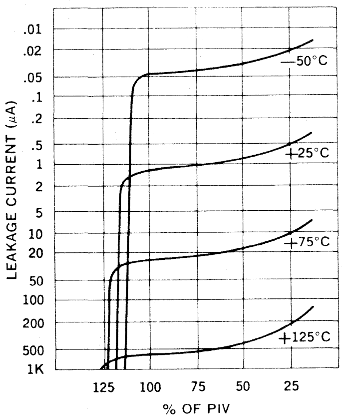
Type	PIV Per Leg	Minimum Reverse Breakdown Voltage Per Leg @ 50μA	Maximum Forward Voltage Drop Per Leg*	Maximum Reverse Recovery Time†	Maximum Leakage Current Per Leg @ PIV	
					$T_C = 25°C$	$T_C = 100°C$
	Volts	Volts		μS	μA	μA
JAN & JANTX 469-1	200	240	1.35V @ 15.7A(pk)	2	2	125
JAN & JANTX 469-2	400	460				
JAN & JANTX 469-3	600	660				

*Maximum forward voltage drop is measured at a pulse width of 8.3ms.
†Measured in a reverse-recovery circuit switching from 0.5A forward to 1.0A reverse current recovering to 0.25A.

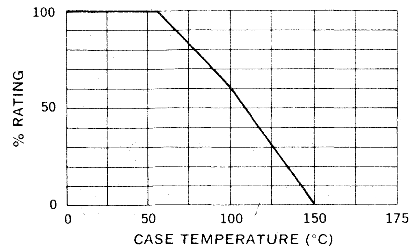
Typical Forward Voltage Per Leg vs. Forward Current

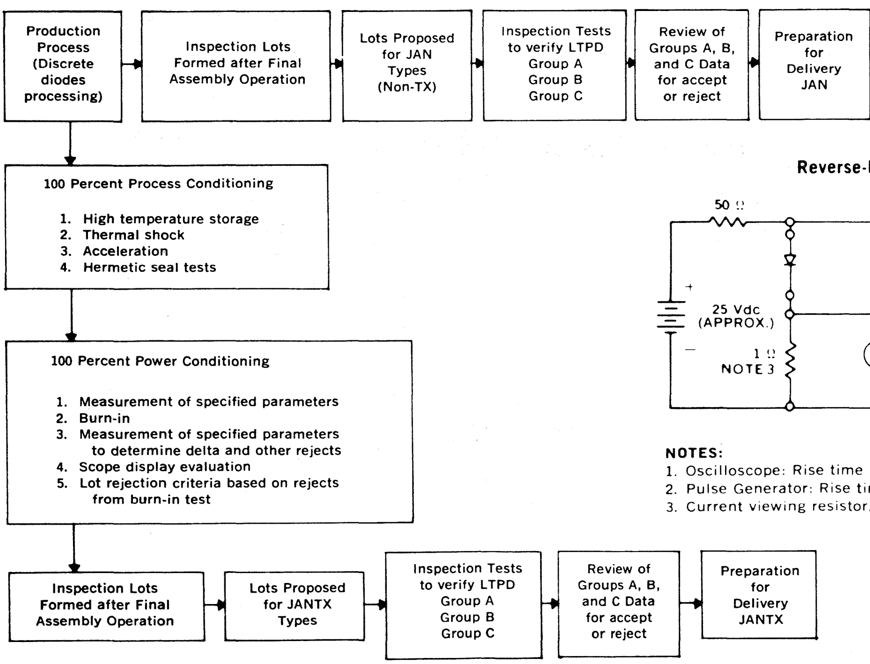


Typical Leakage Current vs. PIV

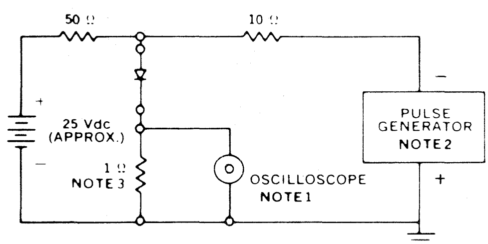


Current Derating Curve





Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

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RECTIFIER ASSEMBLIES

Three Phase Bridges, 25 Amp, Military Approved

JANTX 483-1
JANTX 483-2
JANTX 483-3

FEATURES

- Qualified to MIL-S-19500/483
- Current Rating: 25A
- PIV: from 200 to 600V
- Surge Ratings: 150A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

This military high-current three phase bridge series is assembled with diodes which have been subjected to TX type screening tests. This series of bridges offers the utmost in high reliability as normally required in military system design.

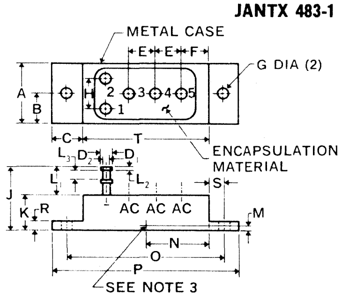
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage .... 200 to 600V
Maximum Average D.C. Output Current
@ $T_C = 55°C$ 25A
@ $T_C = 100°C$ 18.5A
Non-Repetitive Sinusoidal Surge (8.3ms)
@ $T_C = 55°C$ 150A
Operating and Storage Temperature Range .... −65°C to +150°C
Thermal Resistance Junction to Ambient .... 20°C/W
Junction to Case .... 2.5°C/W

DIMENSIONS				
LTR	INCH		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	.730	.770	18.54	19.56
B	.355	.395	9.02	10.03
C	.355	.395	9.02	10.03
D_1	.141	.151	3.58	3.84
D_2	.108	.118	2.74	3.00
E	.355	.395	9.02	10.03
F	.230	.270	5.84	6.86
G	.149	.189	3.78	4.80
H	.355	.395	9.02	10.03
J		.82		20.83
K	.39	.51	9.91	12.95
L_1	.240	.320	6.10	8.13
L_2	.015	.030	.38	.76
L_3	.100	.125	2.54	3.18
M	.040	.060	1.02	1.52
N	.72	.78	18.29	19.81
O	1.84	1.90	46.74	48.26
P	2.22	2.28	56.39	57.91
R	.09	.15	2.29	3.81
S	.168	.208	4.27	5.28
T	1.47	1.53	37.34	38.86

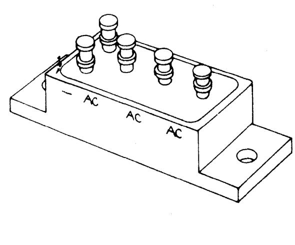
MECHANICAL SPECIFICATIONS

JANTX 483-1 JANTX 483-2 JANTX 483-3



See Table Above

Typical Weight — 1.0 ounces
30 grams



NOTES:
1. Terminals shall be tinned.
2. Polarity shall be marked as shown on drawing.
3. Point at which T_C is read (shall be in metal part of case).

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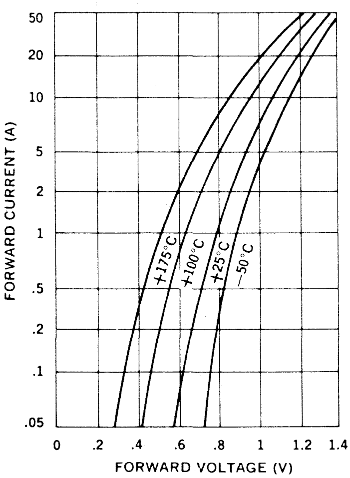
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

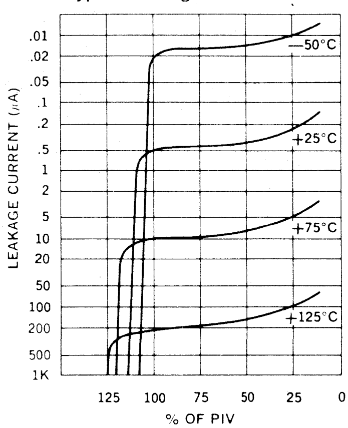
Type	PIV Per Leg	Breakdown Voltage Per Leg @ 50μA	Maximum Forward Voltage Drop Per Leg*	Maximum Leakage Current Per Leg @ PIV	
				$T_C = 25°C$	$T_C = 100°C$
	Volts	Volts		μA	μA
JAN 483-1	200	240	1.3V @ 39A (pk)	2	200
JAN 483-2	400	480			
JAN 483-3	600	660			

* Maximum forward voltage drop is measured at a pulse width of 8.3ms, duty cycle ≤2%.

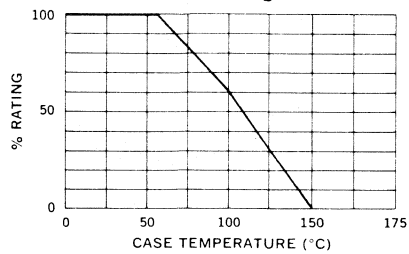
Typical Forward Voltage Per Leg vs. Forward Current

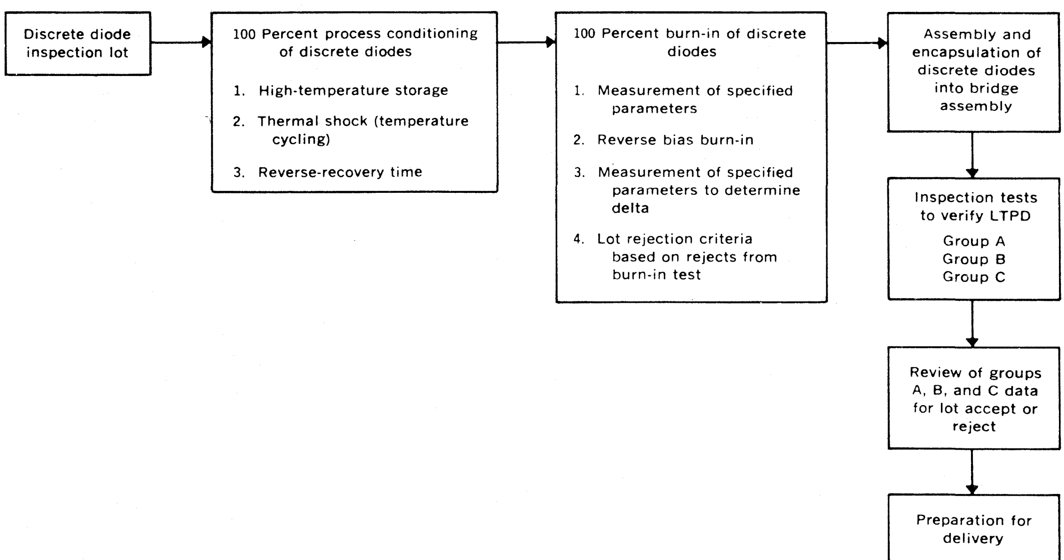


Typical Leakage Current vs. PIV



Current Derating Curve





RECTIFIER ASSEMBLIES

673, 676 SERIES

Single Phase Bridges, 1.5Amp, Standard and Fast Recovery

FEATURES
- Miniature Package
- Surge Ratings: to 25A
- PIV's: from 100 to 600V
- Recovery Times: to 500ns
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

DESCRIPTION

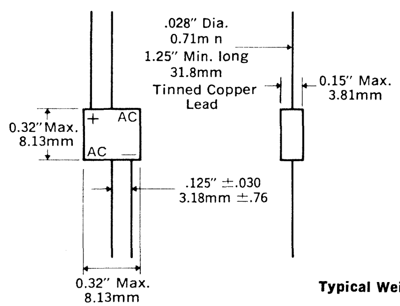
These miniature transfer-molded single-phase power bridges are designed for universal application in power supplies. One basic bridge assembly comes in a choice of lead configurations for mounting in wired chassis or on printed boards.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3mS)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	50°C/W

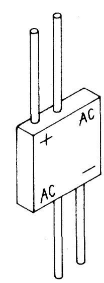
MECHANICAL SPECIFICATIONS

673, 676 SERIES

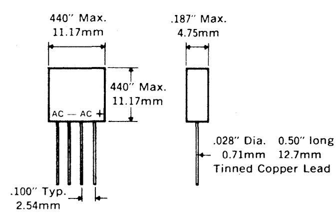


Typical Weight G: 0.05 ounces
1.4 grams

G BODY



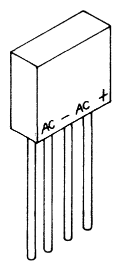
673, 676 SERIES



When specifying S body, add suffix S i.e., 673-1S

Typical Weight S: 0.11 ounces
3.1 grams

S BODY



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

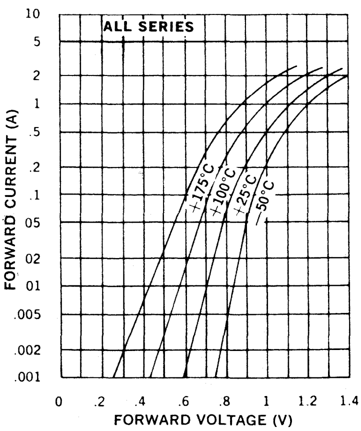
Part number is printed on the body.

UNITRODE

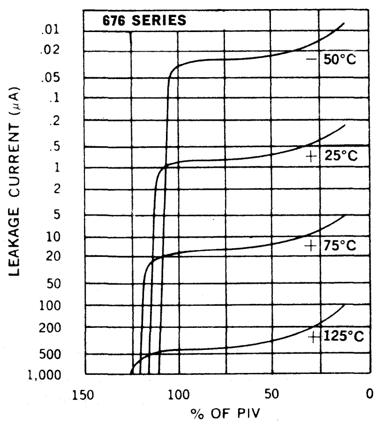
Electrical Specifications (at 25°C unless noted)							Maximum Ratings	
Type		PIV Per Leg	Maximum Forward Drop Per Leg	Leakage Current Per Leg $T_A = 25°C$	Leakage Current Per Leg $T_A = 100°C$	Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current $T_A = 25°C$	Non-Repetitive Sinusoidal Surge (8.3mS)
		Volts		μA	μA	ns	Amps	Amps
Standard Recovery	673-1	100	1.1V @ 1.0A	2	100	—	1.5	25
	673-2	200						
	673-3	300						
	673-4	400						
	673-5	500						
	673-6	600						
Fast Recovery	676-1	100	1.1V @ 0.5A	3	150	500	1.0	20
	676-2	200						
	676-3	300						
	676-4	400						
	676-5	500						
	676-6	600						

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

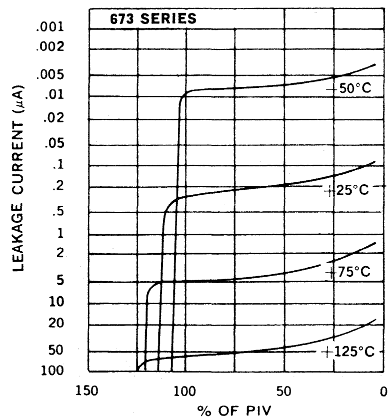
Typical Forward Voltage Per Leg vs. Forward Current



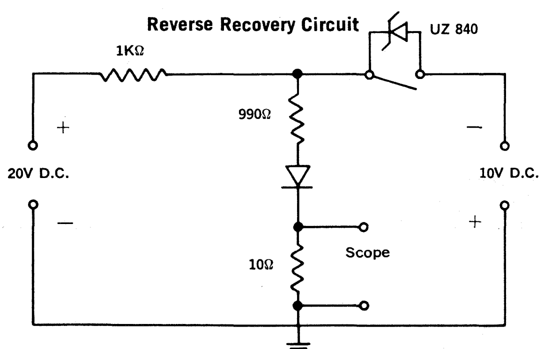
Typical Leakage Current vs. PIV



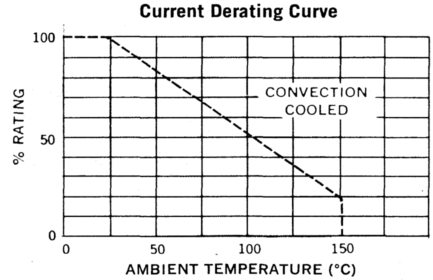
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



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RECTIFIER ASSEMBLIES

673, 676 SERIES
(1200-5000V)

Single Phase Bridges, High Voltage 0.125-0.6 Amp, Standard and Fast Recovery

FEATURES

- Miniature High Voltage Bridges
- Continuous Ratings: to 0.6A
- Surge Ratings: to 15A
- PIV's: from 1200 to 5000V
- Recovery Times: to 500ns
- Controlled Avalanche Characteristics
- Only Fused in Glass Diodes Used

DESCRIPTION

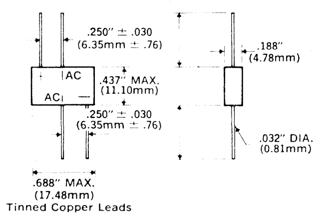
These miniature molded high-voltage single phase bridges are designed for universal application in power supplies. The miniature package is shatterproof and is capable of handling extremes in temperature, vibration and shock. These bridges, therefore are ideally suited for miniaturized, tigntly packaged equipment operating in extreme environments.

ABSOLUTE MAXIMUM RATINGS

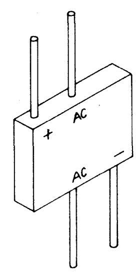
Peak Inverse Voltage	1200 to 5000V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction-to-Ambient	50°C/W

MECHANICAL SPECIFICATIONS

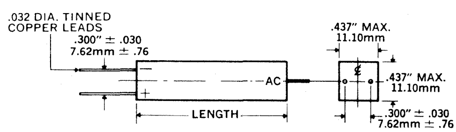
673-7



Body H



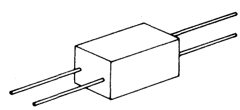
673, 676 SERIES



MAX. LENGTHS

J	K	L	M	N	O	P
.562″ 14.27mm	.688″ 17.48mm	.875″ 22.23mm	1.125″ 28.58mm	1.25″ 31.75mm	1.375″ 34.92mm	1.625″ 41.28mm

BODY J through P



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative Output	—

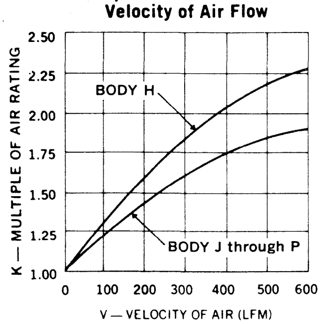
Part number is printed on the body.

UNITRODE

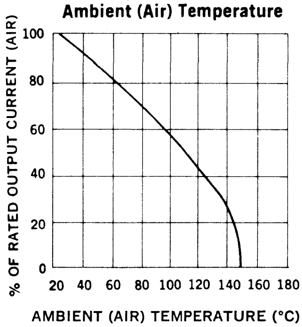
Type		Electrical Specifications at 25°C						Maximum Ratings		
		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Body Size	Maximum Average D.C. Output Current		Non-repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$			$T_A = 25°C$ Air	$T_A = 50°C$ Oil	
		Volts		μA	μA	ns		Amps	Amps	Amps
Standard Recovery	673-7	1200	2.2V @ 0.4A	2	100		H	0.6	1.5	15
	673-75	1800	3.3V @ 0.4A				J	0.5	1.25	
	673-8	2400	4.4V @ 0.4A				K	0.4	1.0	
	673-85	3000	5.5V @ 0.3A				L	0.3	0.75	
	673-9	3600	6.6V @ 0.2A				M	0.2	0.5	
	673-10	4200	7.7V @ 0.2A				N	0.18	0.45	
	673-11	4800	8.8V @ 0.15A				O	0.16	0.4	
	673-12	5000	9.0V @ 0.15A				O	0.16	0.4	
Fast Recovery	676-12	1200	3.3V @ 0.3A	5	150	500	J	0.4	1.0	10
	676-18	1800	4.4V @ 0.2A				K	0.35	0.85	
	676-24	2400	5.5V @ 0.2A				L	0.325	0.8	
	676-30	3000	7.7V @ 0.2A				M	0.25	0.625	
	676-36	3600	8.8V @ 0.15A				N	0.175	0.425	
	676-42	4200	9.9V @ 0.15A				O	0.15	0.375	
	676-48	4800	11V @ 0.15A				P	0.135	0.325	
	676-50	5000	11V @ 0.15A				P	0.125	0.3	

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

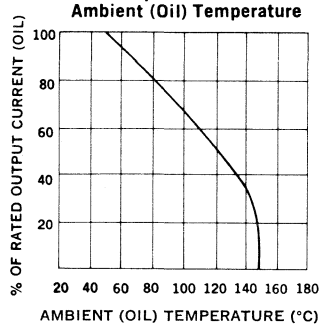
Output Current Ratio vs Velocity of Air Flow



Output Current vs Ambient (Air) Temperature

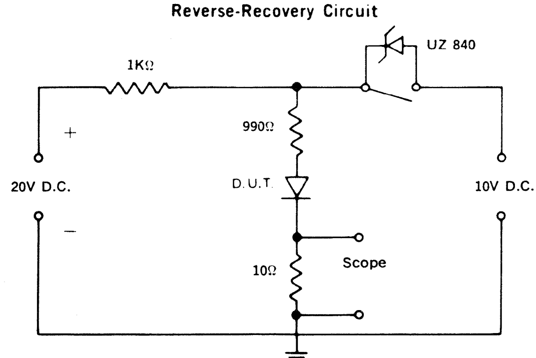


Output Current vs Ambient (Oil) Temperature



Application example: The rectifier is to be used in a cabinet at 60°C with ambient air moving at 400 LFM. The rating is reduced (Fig. 2) by a factor of 0.81 due to the elevated temperature, but is enhanced by 2.X (Fig. 1) due to the air flow. Hence the DC output current is 0.81 x 2, or 1.6 times the 25°C air rating.

Reverse-Recovery Circuit



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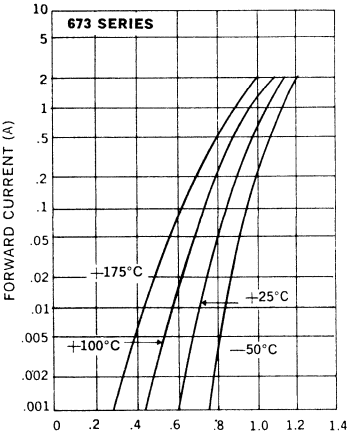
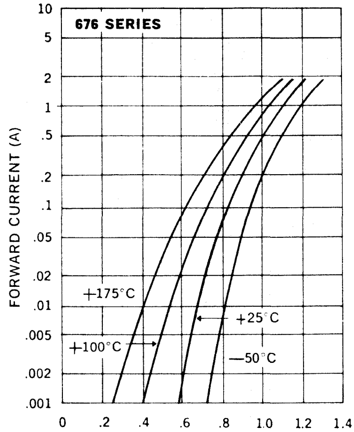
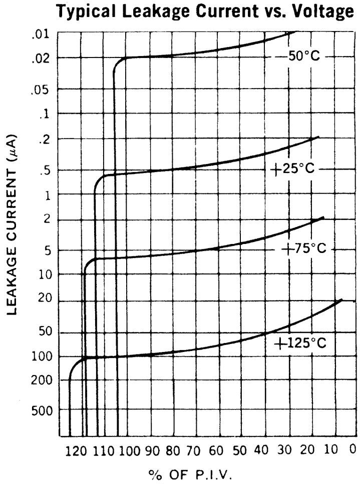
Typical Forward Voltage vs Forward Current



Typical Forward Voltage vs Forward Current



Typical Leakage Current vs. Voltage



RECTIFIER ASSEMBLIES

Three Phase Bridges, 15-25 Amp, Standard and Fast Recovery Magnum®

678, 682, 695
696 SERIES

FEATURES

- Current Rating: to 25A
- PIVs: from 100 to 600V
- Only Fused-in-Glass Diodes Used
- Recovery Times: to 500ns
- Controlled Avalanche Characteristics
- Surge Ratings: to 150A
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

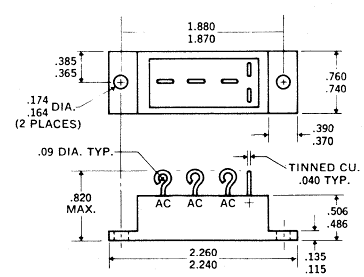
This series of three phase MAGNUM® bridges offer the ultimate in high current power supply applications. The fast recovery series allows operation at full power at high frequencies (up to 40KHz squarewave), often used in choppers, inverters and converters in aircraft, missiles, etc., equipment.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, All Series	20°C/W
Junction to Case, 678, 682 Series	1.5°C/W
Junction to Case, 695, 696 Series	3.0°C/W

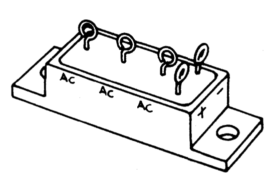
MECHANICAL SPECIFICATIONS

678, 682, 695, 696 SERIES



Dimensions in inches.

Typical Weight — 30 grams



MARKING

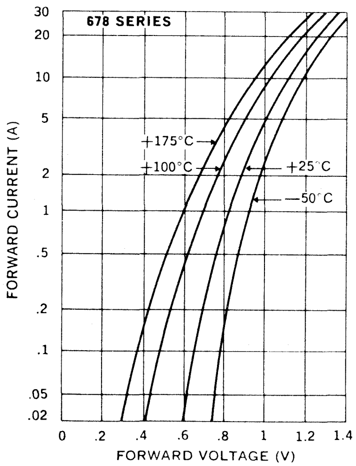
Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

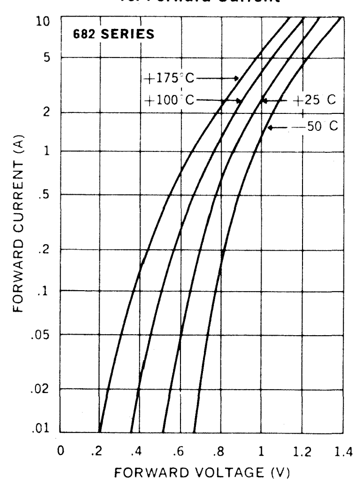
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	$T_A = 100°C$
		Volts		μA	μA	ns	Amps	Amps	Amps
Standard Recovery	678-1	100	1.2V @ 10A	10	200	—	25	18.5	150
	678-2	200							
	678-3	300							
	678-4	400							
	678-5	500							
	678-6	600							
Standard Recovery	695-1	100	1.2V @ 2A	5	150	—	15	9	80
	695-2	200							
	695-3	300							
	695-4	400							
	695-5	500							
	695-6	600							
Fast Recovery	682-1	100	1.2V @ 6A	10	200	500	20	14	150
	682-2	200							
	682-3	300							
	682-4	400							
	682-5	500							
	682-6	600							
Fast Recovery	696-1	100	1.2V @ 2A	5	150	500	15	9	60
	696-2	200							
	696-3	300							
	696-4	400							
	696-5	500							
	696-6	600							

*Measured in a reverse recovery circuit switching from 1.0A forward to 1.0A reverse current recovering to 0.5A.

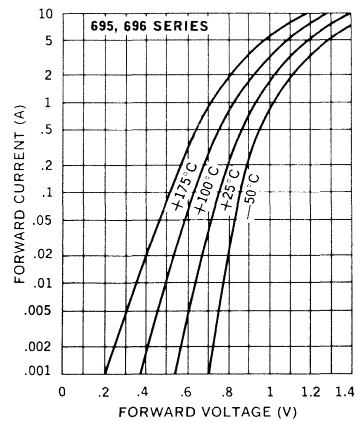
Typical Forward Voltage Per Leg vs. Forward Current



Typical Forward Voltage Per Leg vs. Forward Current



Typical Forward Voltage Per Leg vs. Forward Current



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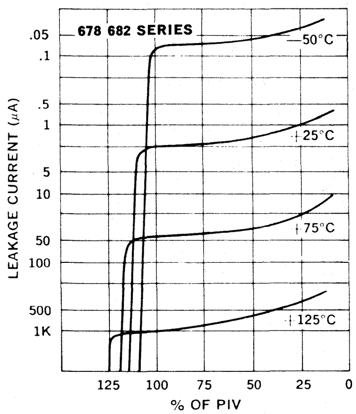
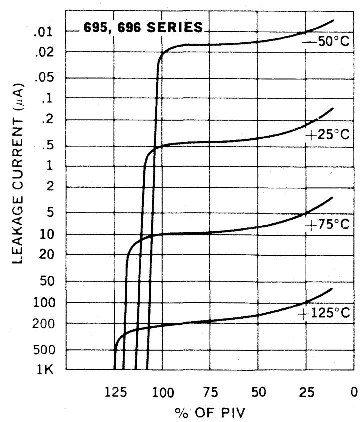
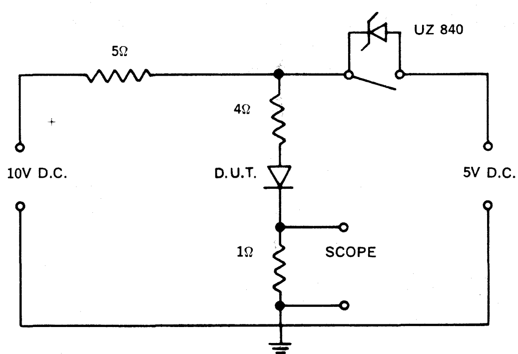
Typical Leakage Current vs. PIV



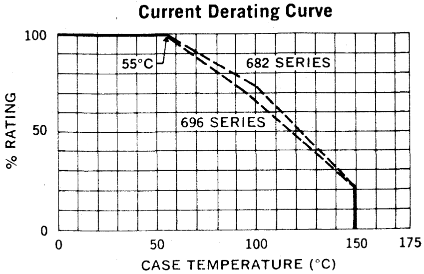
Typical Leakage Current vs. PIV



Reverse Recovery Circuit

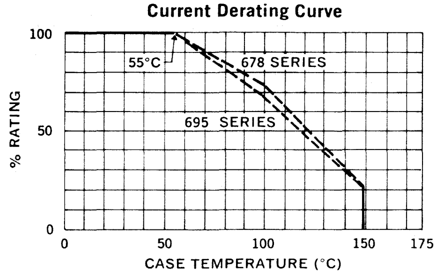


Current Derating Curve



Fast Recovery Series

Current Derating Curve



Standard Recovery Series

RECTIFIER ASSEMBLIES

679, 680, 683, 684 SERIES

Single Phase Bridges, 10-25 Amp, Standard and Fast Recovery Magnum™

FEATURES

- Current Ratings: to 25A
- Recovery Time: to 500ns
- PIVs: from 100 to 600V
- Surge Ratings: to 150A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

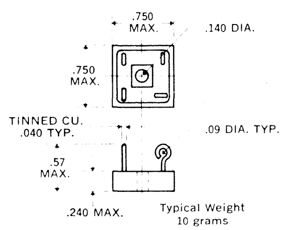
This series of single phase MAGNUM™ bridge offers the designer the ultimate in high current power supply applications. The fast recovery series allows operation at full power at high frequencies, up to 40kHz square wave, which is often used in chopper, inverters and converters in aircraft, missiles, etc., equipment.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, 679, 683 Series	20°C/W
Junction to Ambient, 680, 684 Series	25°C/W
Junction to Case, 679, 683 Series	2.0°C/W
Junction to Case, 680, 684 Series	4.0°C/W

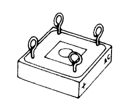
MECHANICAL SPECIFICATIONS

680, 684 SERIES

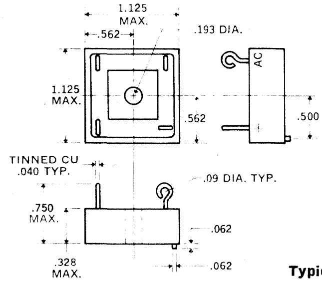


Dimensions in inches.

Typical Weight — 0.35 ounces
10 grams

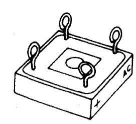


679, 683 SERIES



Dimensions in inches.

Typical Weight — 0.7 ounces
20 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

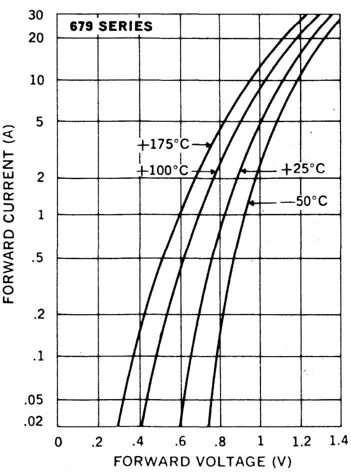
Part number is printed on the body.

UNITRODE

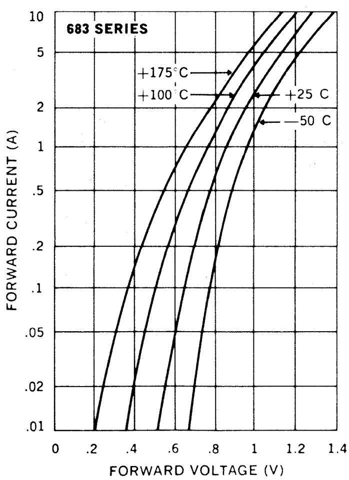
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	$T_A = 100°C$
		Volts		μA	μA	ns	Amps	Amps	Amps
Standard	679-1	100							
Recovery	679-2	200							
	679-3	300	1.2V @ 10A	10	200	—	25	18.5	150
	679-4	400							
	679-5	500							
	679-6	600							
Standard	680-1	100							
Recovery	680-2	200							
	680-3	300	1.2V @ 2A	2	50	—	10	6	50
	680-4	400							
	680-5	500							
	680-6	600							
Fast	683-1	100							
Recovery	683-2	200							
	683-3	300	1.2V @ 6A	10	200	500	20	14	150
	683-4	400							
	683-5	500							
	683-6	600							
Fast	684-1	100							
Recovery	684-2	200							
	684-3	300	1.2V @ 2A	5	100	500	10	6	50
	684-4	400							
	684-5	500							
	684-6	600							

*Measured in a reverse recovery circuit switching from 1.0A forward to 1.0A reverse current recovering to 0.5A.

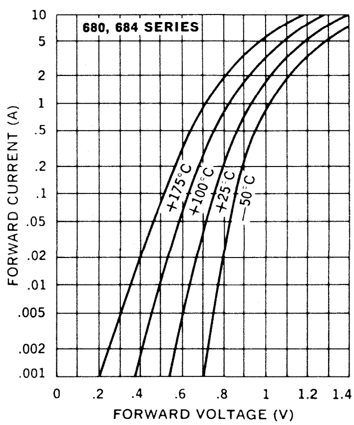
Typical Forward Voltage Per Leg vs. Forward Current



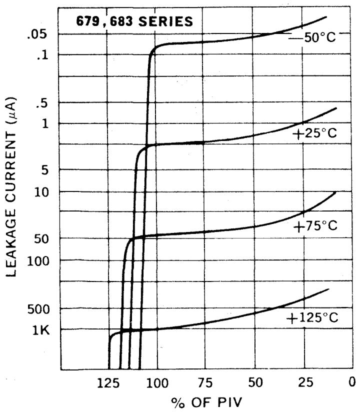
Typical Forward Voltage Per Leg vs. Forward Current



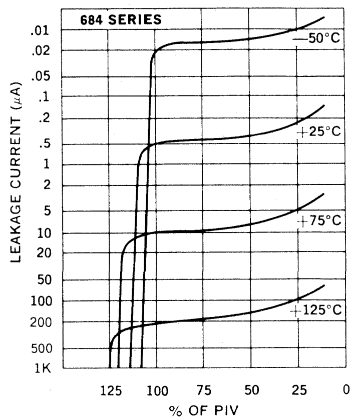
Typical Forward Voltage Per Leg vs. Forward Current



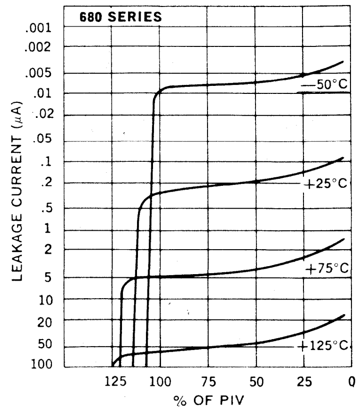
Typical Leakage Current vs. PIV



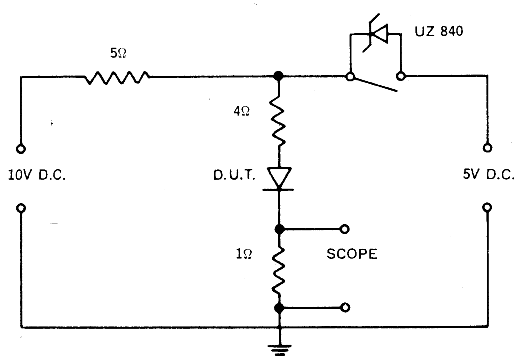
Typical Leakage Current vs. PIV



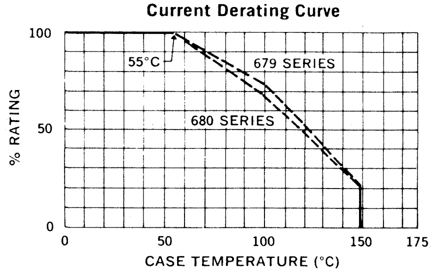
Typical Leakage Current vs. PIV



Reverse Recovery Circuit

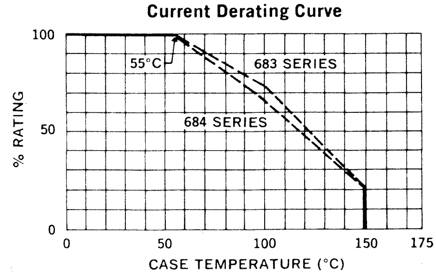


Current Derating Curve



Standard Recovery Series

Current Derating Curve



Fast Recovery Series

RECTIFIER ASSEMBLIES

681, 689 SERIES

Doubler and Center Tap, 15 Amp, Standard and Fast Recovery, Magnum®

FEATURES
- Current Ratings: to 15A
- Aluminum Heat Sink Case, Electrically Insulated
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- PIV: 100 to 600V
- Surge Ratings: to 150A

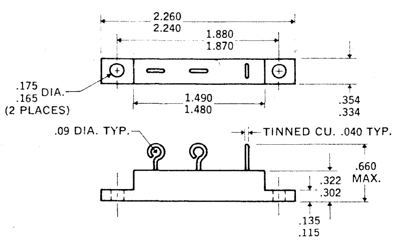
DESCRIPTION
This series of MAGNUM® doublers and center tap rectifiers offers high current and high thermal conductivity needed in high current power supply applications. The MAGNUM® package is virtually indestructable and lends its use to high environmental stresses, as seen in aircraft, missile and satellite equipment.

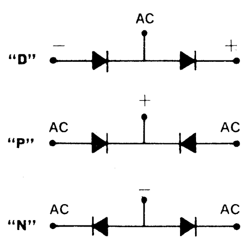
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltages	100 to 600V
Maximum Average D.C. Output Current	
@ $T_C = +55°C$	15A
@ $T_C = +100°C$	10A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_A = +100°C$	150A
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction to Ambient	20°C/W
Junction to Case	6.0°C/W

MECHANICAL SPECIFICATIONS

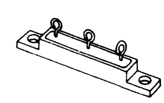
681, 689 SERIES





Dimensions in inches.

Typical Weight — 0.35 ounces
10 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

† Add suffix P, N, or D for terminal configuration P, N, or D.
For example, for center tap configuration, P, order 681-IP.

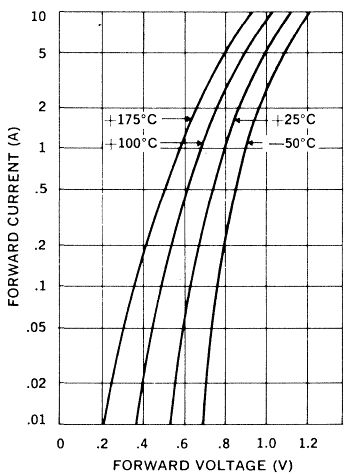
UNITRODE

Electrical Specifications (at 25°C unless noted)

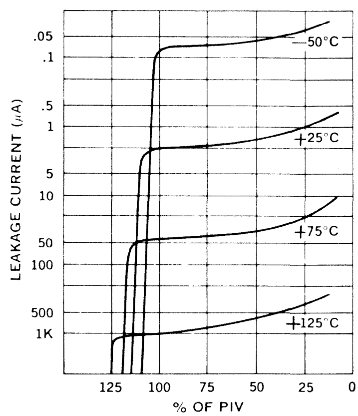
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Reverse Recovery Time*	Maximum Leakage Current Per Leg @ PIV	
					$T_A = 25°C$	$T_A = 100°C$
		Volts		nS	μA	μA
Standard Recovery	681-1	100	1.2V @ 10A		10	200
	681-2	200				
	681-3	300				
	681-4	400				
	681-5	500				
	681-6	600				
Fast Recovery	689-1	100	1.2V @ 10A	500	10	200
	689-2	200				
	689-3	300				
	689-4	400				
	689-5	500				
	689-6	600				

*Measured in a reverse recovery circuit from 1A forward to 1A reverse current recovery to 0.5A.

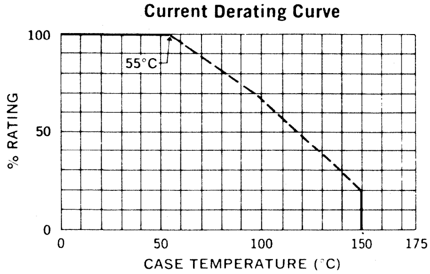
Typical Forward Voltage Per Leg vs. Forward Current



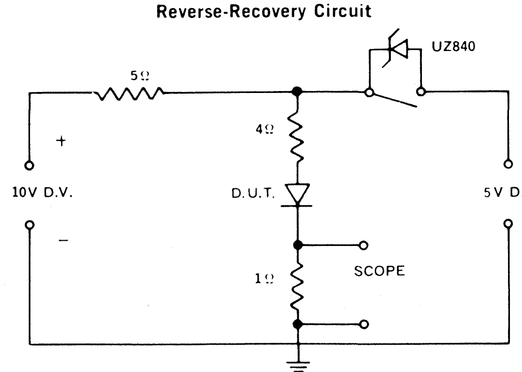
Typical Leakage Current vs. PIV



Current Derating Curve



Reverse-Recovery Circuit



RECTIFIER ASSEMBLIES

685 SERIES

Three Phase Bridges, High Voltage
0.5-1.0 Amp, Standard and Fast Recovery

FEATURES
- Current Ratings: to 1A
- Recovery Time: available to 500ns
- Surge Ratings: to 20A
- PIV: from 2.5KV to 7KV
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Bonded Plate Package For Maximum Heat Transfer

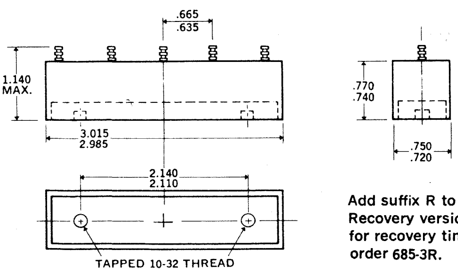
DESCRIPTION
This series of three-phase bridges has a unique packaging design that provides characteristics not obtainable in conventional molded epoxy packages. This series, therefore, is ideally suited for high voltage power supply applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5KV to 7KV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

MECHANICAL SPECIFICATIONS

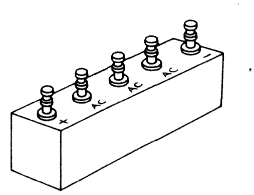
685 SERIES



Add suffix R to denote Fast Recovery version. For example, for recovery time, t_{rr} = 500ns; order 685-3R.

Dimensions in inches.

Typical Weight — 2.5 ounces
70 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

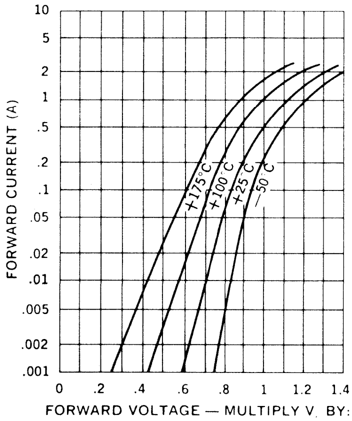
UNITRODE

Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Ratings: Maximum Average D.C. Output Current
				T_A = 25°C	T_A = 100°C	T_C = 100°C
		kV		μA	μA	Amps
Standard And Fast Recovery*	685-2.5	2.5	5V @ .4A	2	100	1.00
	685-3	3	6V @ .4A			0.90
	685-4	4	8V @ .4A			0.80
	685-5	5	9V @ .4A			0.65
	685-7	7	12V @ .4A			0.50

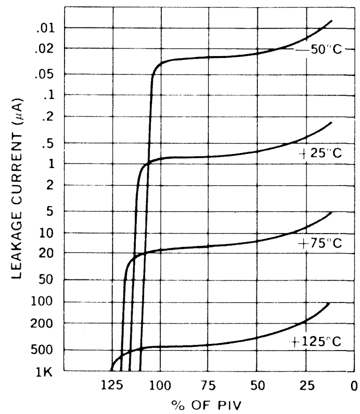
Electrical Specifications (at 25°C unless noted)

*Add suffix R to denote Fast Recovery version, i.e. 685-3R.

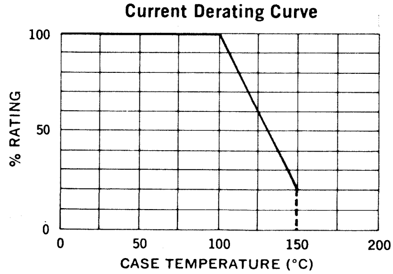
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

686 SERIES

Single Phase Bridges, High Voltage 0.5-1.2 Amp, Standard and Fast Recovery

FEATURES

- Current Ratings: to 1.2A
- PIV: from 2.5kV to 7kV
- Surge Ratings: to 20A
- Recovery Time: Available to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Bonded Plate Package For Maximum Heat Transfer

DESCRIPTION

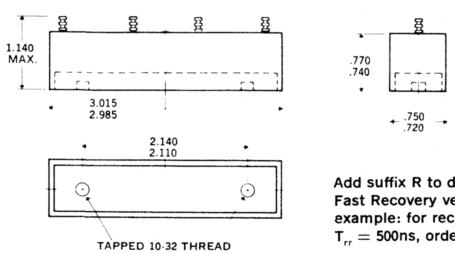
This series of single phase bridges has a unique packaging design providing characteristics not obtainable in conventional molded epoxy packages. This series is ideally suited for high-voltage power supply applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2.5kV to 7kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

MECHANICAL SPECIFICATIONS

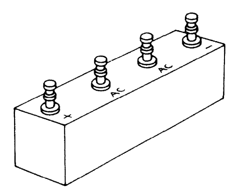
686 SERIES



Add suffix R to denote Fast Recovery version for example: for recovery time, T_{rr} = 500ns, order 686-2.5R.

Typical Weight — 2.5 ounces
70 grams

Dimensions in inches.



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

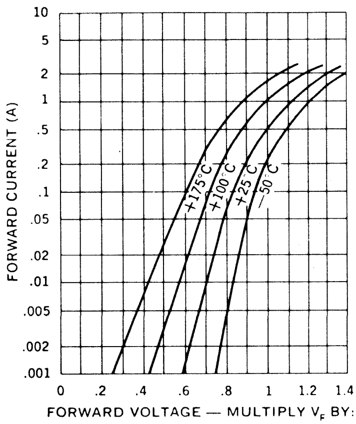
Part number is printed on the body.

UNITRODE

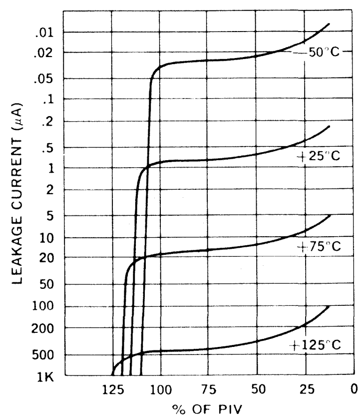
Electrical Specifications (at 25°C unless noted)						Maximum Ratings
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current Per Leg @ PIV		Maximum Average D.C. Output Current
				$T_A = 25°C$	$T_A = 100°C$	@ $T_C = 100°C$
		kV		μA	μA	Amps
Standard	686-2.5	2.5	4V @ .4A			1.20
and Fast	686-3	3	5V @ .4A			1.00
Recovery*	686-4	4	7V @ .4A	2	100	0.75
	686-5	5	9V @ .4A			0.60
	686-7	7	12V @ .4A			0.50

*Add suffix R to denote Fast Recovery version.

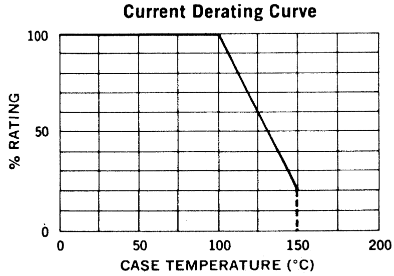
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



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RECTIFIER ASSEMBLIES

High Voltage Stacks, Standard and Fast Recovery

FEATURES

- PIV: from 10kV to 25kV
- Surge Rating: to 20A
- Recovery Time Available: to 500ns
- Current Ratings: to 0.6A
- Bonded Plate for Maximum Heat Transfer
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

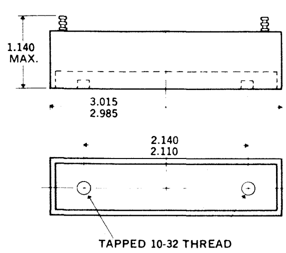
DESCRIPTION

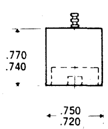
This series of high power stacks has a unique packaging design that provides characteristics not obtainable in conventional molded epoxy packages. This series, therefore, is ideally suited for high-voltage, high-power applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	10kV to 25kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	−65°C to +150°C
Thermal Resistance Junction to Ambient	25°C/W
Junction to Case	10°C/W

688 SERIES

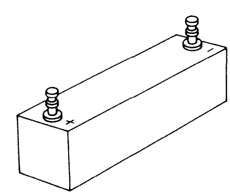




Add suffix R to denote Fast Recovery version. For example, for recovery time, t_{rr} = 500ns; order 688-10R.

Typical Weight — 2.5 ounces
70 grams

Dimensions in inches.



MARKING

Cathode — Positive Output	+
Anode — Negative	—

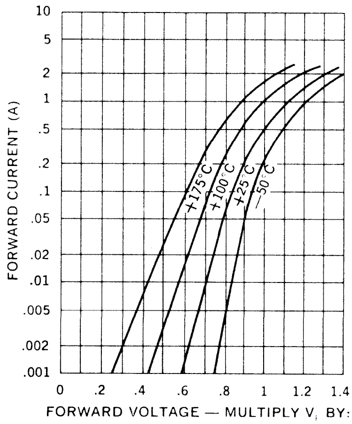
Part number is printed on the body.

UNITRODE

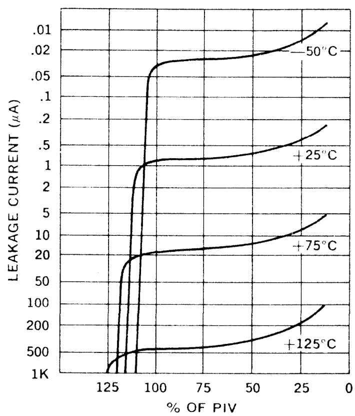
Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Average D.C. Output Current
				Electrical Specifications (at 25°C unless noted)		**Maximum Ratings**
				$T_A = 25°C$	$T_A = 100°C$	$T_C = 100°C$
		kV		μA	μA	Amps
Standard And Fast Recovery*	688-10	10	17V @ 0.4A	2	100	0.60
	688-12	12	20V @ 0.4A			0.50
	688-15	15	25V @ 0.4A			0.40
	688-18	18	30V @ 0.4A			0.35
	688-20	20	34V @ 0.4A			0.30
	688-25	25	42V @ 0.4A			0.20

*Add suffix R to denote Fast Recovery version.

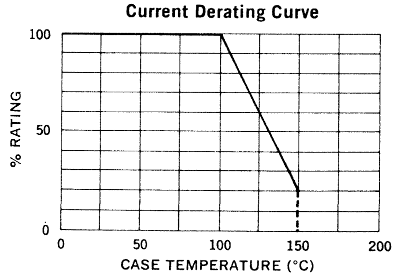
Typical Forward Voltage Per Leg vs. Forward Current



Typical Leakage Current vs. PIV



Current Derating Curve



RECTIFIER ASSEMBLIES

697, 698 SERIES

Single Phase Bridges, 7.5 Amp, Standard and Fast Recovery

FEATURES
- Miniature High Current Assemblies
- Continuous Ratings: to 7.5A
- Surge Ratings: to 80A
- PIV's: from 100V to 600V
- Recovery Times: to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics

DESCRIPTION

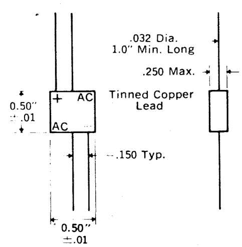
These miniature molded high-current single-phase bridges are designed for universal application in power supplies. One basic bridge fills current requirements up to 7.5A, with PIV's from 100 to 600 volts and recovery times of standard, and 500ns max.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	100 to 600V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	32°C/W
Junction to Case	10°C/W

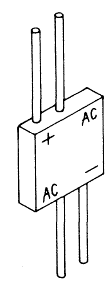
MECHANICAL SPECIFICATIONS

697, 698 SERIES



Typical Weight — 0.14 ounces
4.0 grams

Dimensions in inches.



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

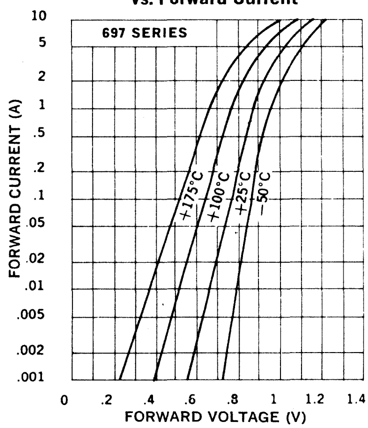
UNITRODE

Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_A = 25°C$	$T_C = 55°C$	
		Volts		μA	μA	ns	Amps	Amps	Amps
Standard Recovery	697-1	100	1.0V @ 2A	5	200		2.5	7.5	80
	697-2	200							
	697-3	300							
	697-4	400							
	697-5	500							
	697-6	600							
Fast Recovery	698-1	100	1.1V @ 2A	5	200	500	2.25	7.0	70
	698-2	200							
	698-3	300							
	698-4	400							
	698-5	500							
	698-6	600							

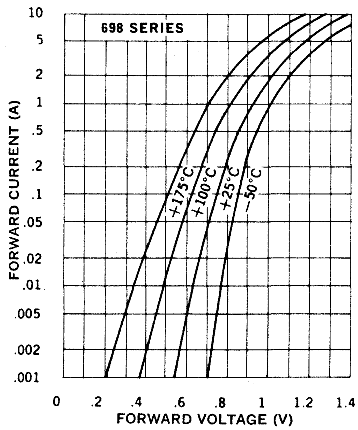
(The "Electrical Specifications (at 25°C unless noted)" heading spans the Type through Maximum Reverse Recovery Time columns; the "Maximum Ratings" heading spans the Maximum Average D.C. Output Current and Non-Repetitive Sinusoidal Surge columns.)

†Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to .5A.

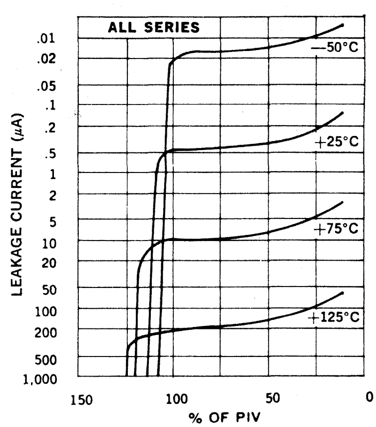
Typical Forward Voltage Per Leg vs. Forward Current



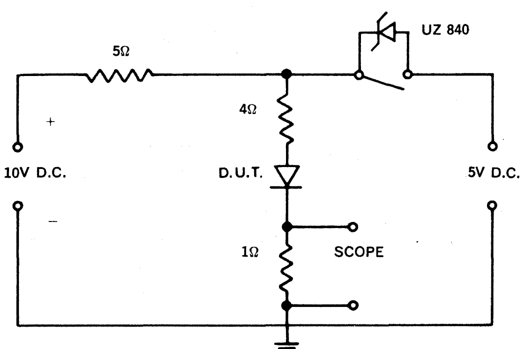
Typical Forward Voltage Per Leg vs. Forward Current



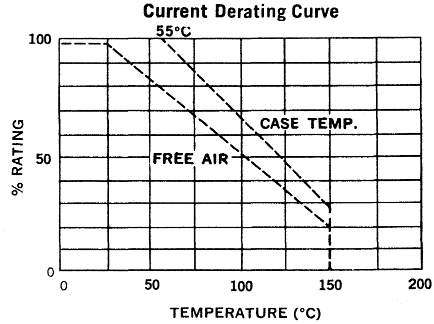
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



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RECTIFIER ASSEMBLIES

700, 701 SERIES

Three Phase Bridges, 2.5 Amp, Standard and Fast Recovery

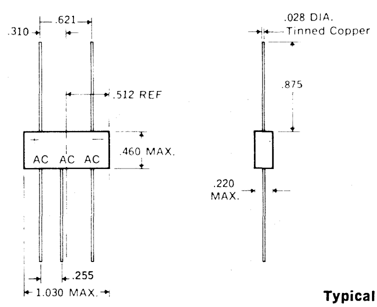
FEATURES
- Miniature Package
- Recovery Time: to 500ns
- Surge Ratings: to 25A
- PIV: from 100 to 600V
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used

DESCRIPTION
These miniature transfer-molded high-voltage three-phase power bridges are designed for universal application in power supplies. One basic bridge fills current requirements up to 2.5A, with PIV's from 100 to 600 volts and recovery times of standard and 500ns.

ABSOLUTE MAXIMUM RATINGS
Peak Inverse Voltage .... 100 to 600V
Maximum Average D.C. Output Current .... See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms) .... See Electrical Specifications
Operating and Storage Temperature Range .... —65°C to +150°C
Thermal Resistance Junction-to-Ambient .... 25°C/W

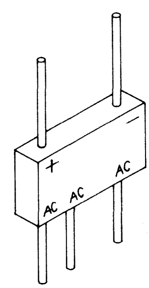
MECHANICAL SPECIFICATIONS

700, 701 SERIES



Dimensions in inches.

Typical Weight — 0.12 ounces
3.5 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

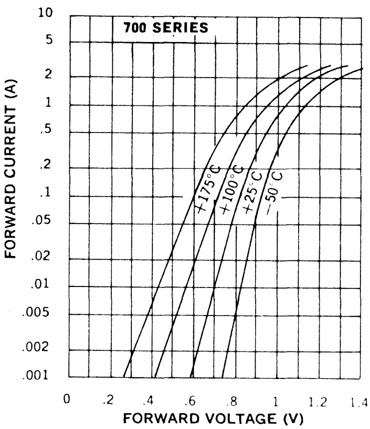
Part number is printed on the body.

UNITRODE

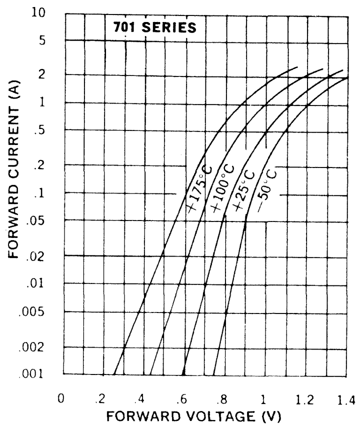
Electrical Specifications (at 25°C unless noted)							Maximum Ratings	
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time†	Maximum Average D.C. Output Current	Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_A = 55°C$	
		Volts		μA	μA	ns	Amps	Amps
Standard Recovery	700-1	100	1.0V @ 0.5A	2	100		2.5	25
	700-2	200						
	700-3	300						
	700-4	400						
	700-5	500						
	700-6	600						
Fast Recovery	701-1	100	1.1V @ 0.5A	2	100	500	2.25	20
	701-2	200						
	701-3	300						
	701-4	400						
	701-5	500						
	701-6	600						

†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

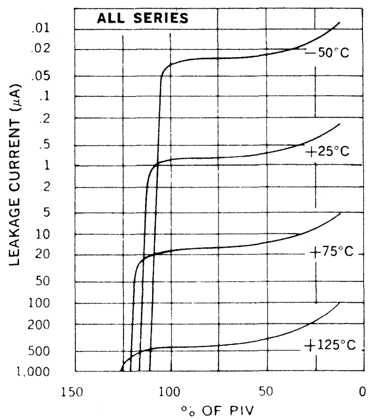
Typical Forward Voltage Per Leg vs. Forward Current



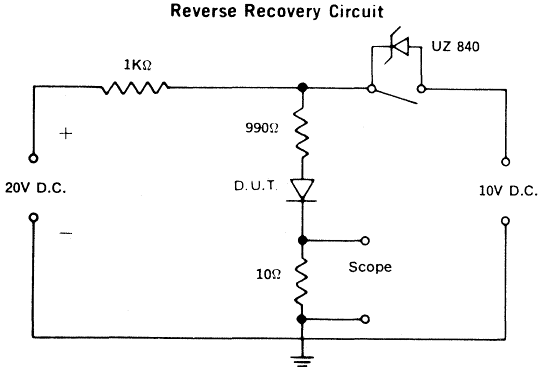
Typical Forward Voltage Per Leg vs. Forward Current



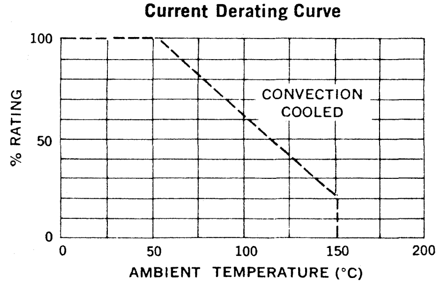
Typical Leakage Current vs. PIV



Reverse Recovery Circuit



Current Derating Curve



RECTIFIER ASSEMBLIES

Three Phase Bridges, 20-40 Amp, High Efficiency, ESP

FEATURES

- Current Ratings: to 40A
- Recovery Time: 50ns
- Surge Ratings: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptionally High Efficiency
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION

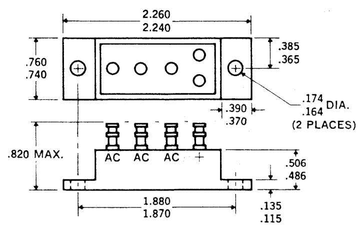
This series of three phase bridges offers the highest efficiency possible for applications where nothing else will do. The series allows operation at full power at high frequencies.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltages	50 to 150V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, All Series	20°C/W
Junction to Case, 800 Series	2.5°C/W
Junction to Case, 801 Series	3.0°C/W

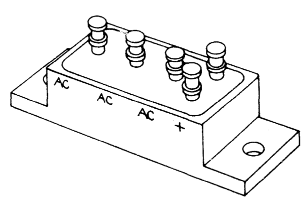
MECHANICAL SPECIFICATIONS

800, 801 SERIES



Dimensions in inches.

Typical Weight — 1.0 ounce
30 grams



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

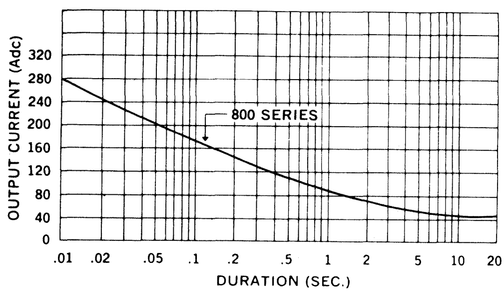
Part number is printed on the body.

Type		PIV Per Leg (Volts)	Maximum Forward Voltage Drop Per Leg	Maximum Reverse Leakage Current Per Leg @ PIV, $T_A = 25°C$ (μA)	Maximum Reverse Leakage Current Per Leg @ PIV, $T_A = 100°C$ (μA)	Maximum Reverse Recovery Time* (ns)	Maximum Average D.C. Output Current, $T_C = 55°C$ (Amps)	Maximum Average D.C. Output Current, $T_C = 100°C$ (Amps)	Non-Repetitive Sinusoidal Surge (8.3ms), $T_A = 100°C$ (Amps)
ESP Recovery	800-1	50	.95V @ 10A	20	1000	50	40	25	250
	800-2	100							
	800-3	125							
	800-4	150							
ESP Recovery	801-1	50	.95V @ 6A	10	300	50	20	16	125
	801-2	100							
	801-3	125							
	801-4	150							

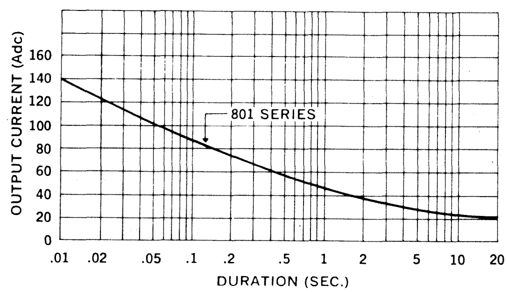
Electrical Specifications (at 25°C unless noted) / Maximum Ratings

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

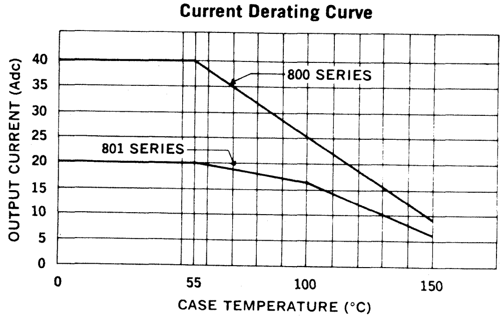
Forward Surge Current vs. Duration



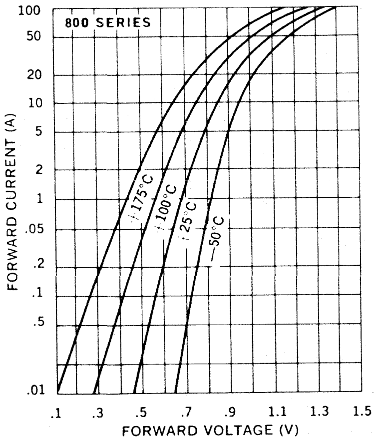
Forward Surge Current vs. Duration



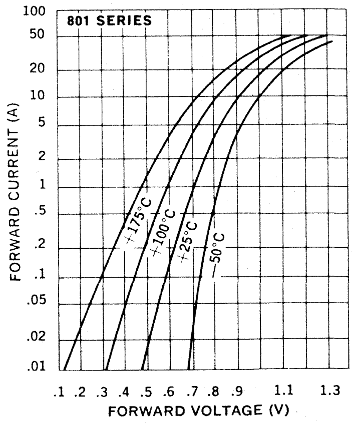
Current Derating Curve



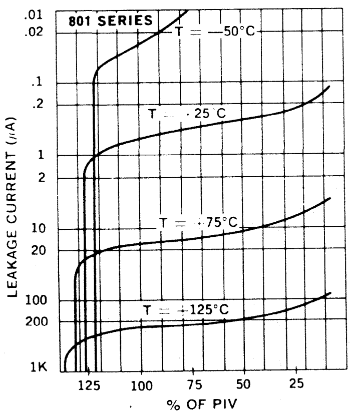
Typical Forward Voltage Per Leg vs. Forward Current



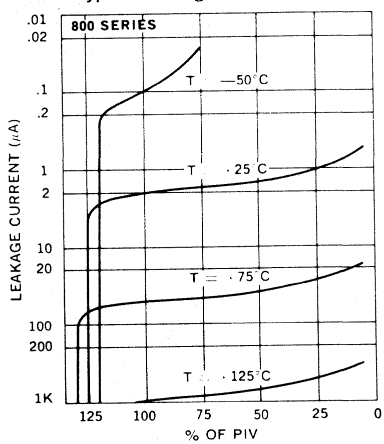
Typical Forward Voltage Per Leg vs. Forward Current



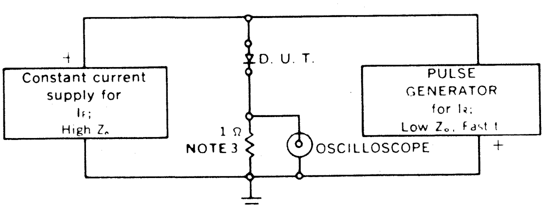
Typical Leakage Current vs. PIV



Typical Leakage Current vs. PIV



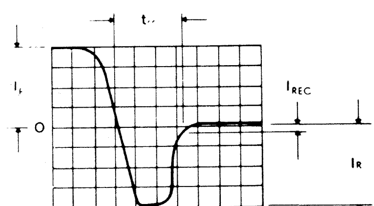
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



SET TIME BASE FOR 5 NS/CM

RECTIFIER ASSEMBLIES

802, 803 SERIES

Single Phase Bridges, 20-35 Amp, High Efficiency ESP Series

FEATURES
- Current Ratings: to 35A
- Recovery Time: 50ns
- Surge Ratings: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptional High Efficiency
- Aluminum Heat Sink Case, Electrically Insulated

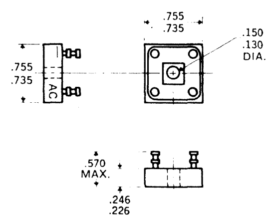
DESCRIPTION
This series of single phase bridges offer the highest efficiency possible for applications where nothing else will do. The series allow operation at full power at very high frequency.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	50 to 150V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient, 802 Series	20°C/W
803 Series	25°C/W
Junction to Case, 802 Series	2.0°C/W
803 Series	4.0°C/W

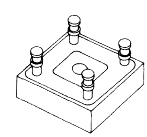
MECHANICAL SPECIFICATIONS

803 SERIES

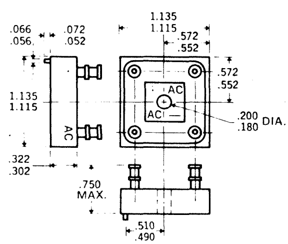


Dimensions in inches.

Typical Weight — 0.35 ounces
10 grams

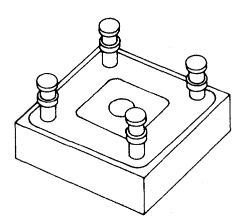


802 SERIES



Dimensions in inches.

Typical Weight — 0.70 ounces
20 grams

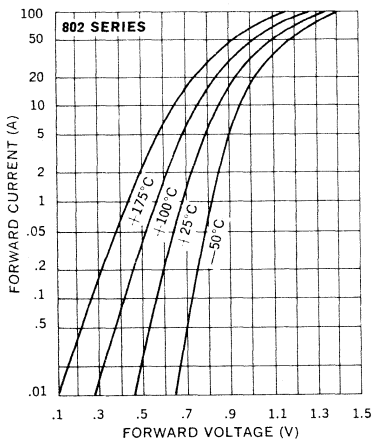


UNITRODE

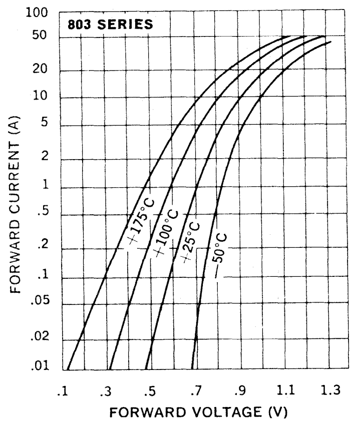
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Reverse Leakage Current Per Leg @ PIV		Maximum Reverse Recovery Time*	Maximum Average D.C. Output Current		Non-Repetitive Sinusoidal Surge (8.3ms)
				$T_A = 25°C$	$T_A = 100°C$		$T_C = 55°C$	$T_C = 100°C$	$T_A = 100°C$
		Volts		μA	μA	ns	Amps	Amps	Amps
ESP Recovery	802-1	50	.95V @ 10A	20	1000	50	35	22.5	250
	802-2	100							
	802-3	125							
	802-4	150							
ESP Recovery	803-1	50	.95V @ 6A	10	300	50	20	16	125
	803-2	100							
	803-3	125							
	803-4	150							

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

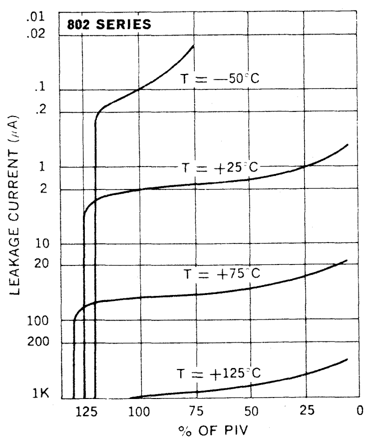
Typical Forward Voltage Per Leg vs. Forward Current



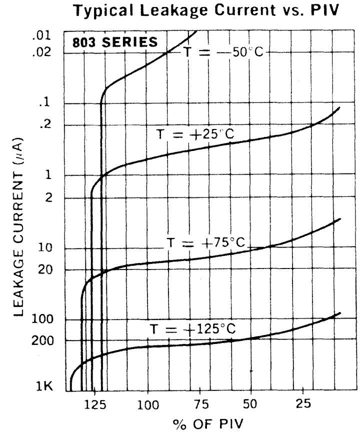
Typical Forward Voltage Per Leg vs. Forward Current



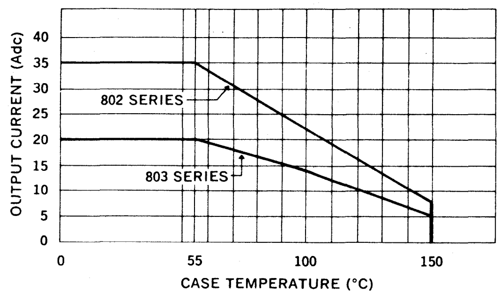
Typical Leakage Current vs. PIV



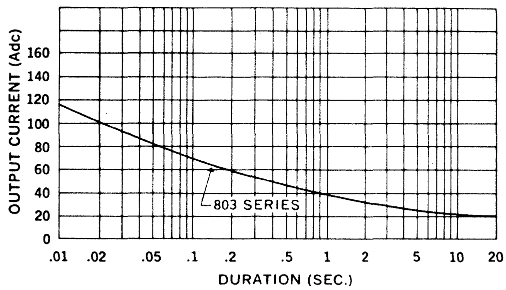
Typical Leakage Current vs. PIV



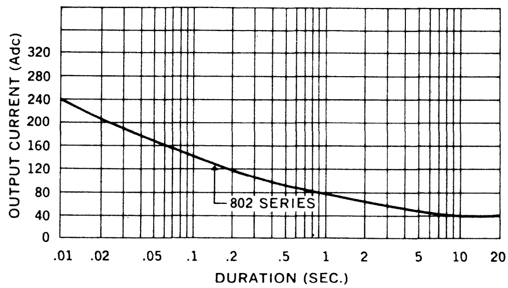
Current Derating Curve



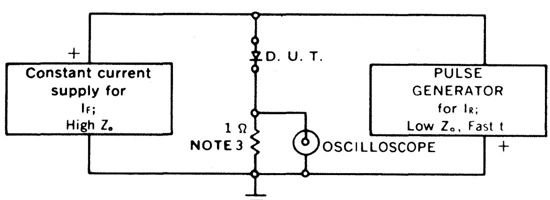
Forward Surge Current vs. Duration



Forward Surge Current vs. Duration



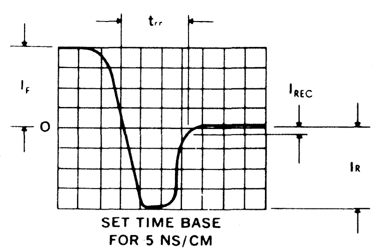
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



RECTIFIER ASSEMBLIES

Doublers and Center Tap, 20 Amp, High Efficiency, ESP

FEATURES

- Current Rating: to 20A
- Aluminum Heat Sink Case, Electrically Insulated
- Recovery Time: 50ns
- Surge Rating: to 250A
- PIVs: from 50 to 150V
- Only Fused-in-Glass Diodes Used
- Exceptional High Efficiency

DESCRIPTION

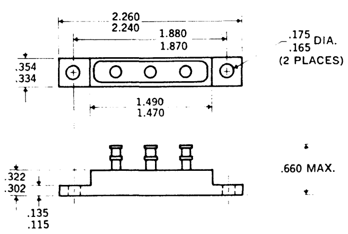
This series of doublers and center tap rectifiers offer the ultimate in high efficiency application. The rectifiers are particularly suited to switching regulator supplies where very fast recovery time and low forward drop are of prime importance.

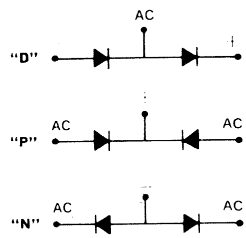
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	50 to 150V
Maximum Average D.C. Output Current	
@ $T_C = +55°C$	20A
@ $T_C = +100°C$	14A
Non-Repetitive Sinusoidal Surge (8.3ms)	
@ $T_A = +100°C$	250A
Operating and Storage Temperature Range	—65°C to +150°C
Thermal Resistance Junction to Ambient	20°C/W
Junction to Case	6.0°C/W

MECHANICAL SPECIFICATIONS

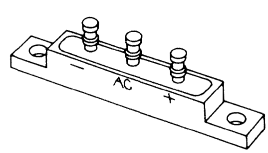
804 SERIES





Typical Weight — 0.35 ounces
10 grams

Dimensions in inches.



MARKING

Alternating Current Input	A.C.
Cathode — Positive Output	+
Anode — Negative	—

Part number is printed on the body.

† Add suffix P, N, or D for terminal configuration P, N, or D.
For example, for center tap configuration, P, order 804-IP

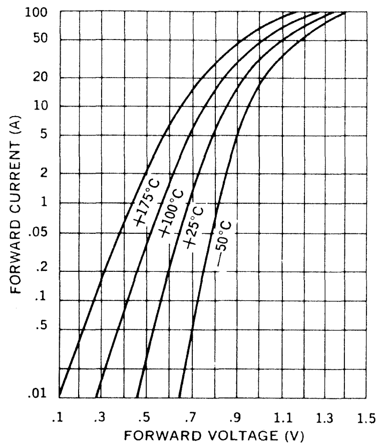
UNITRODE

Electrical Specifications (at 25°C unless noted)

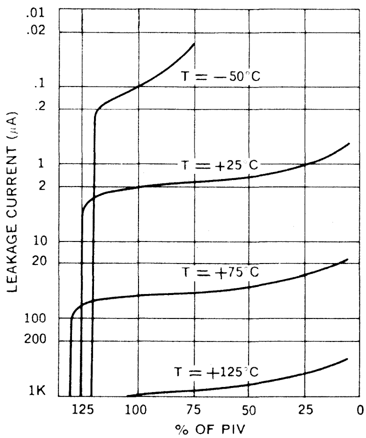
Type		PIV Per Leg	Maximum Forward Voltage Drop Per Leg	Maximum Leakage Current (μA) Per Leg @ PIV		Maximum Reverse Recovery Time*
				$T_A = 25°C$	$T_A = 100°C$	
		Volts		μA	μA	ns
ESP Recovery	804-1	50	.95V @ 10A	10	500	50
	804-2	100				
	804-3	125				
	804-4	150				

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.

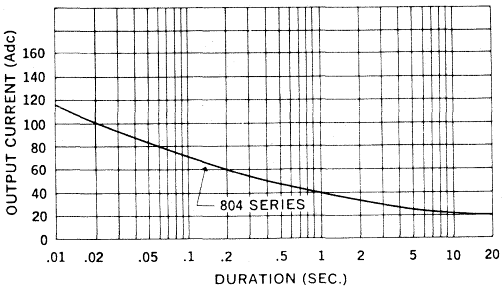
Typical Forward Voltage Per Leg vs. Forward Current



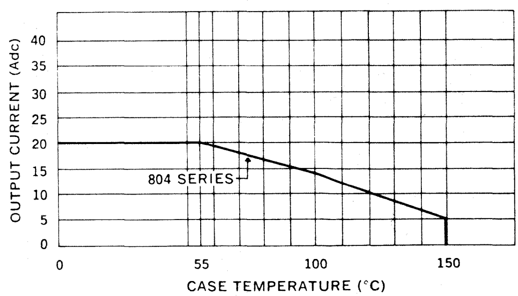
Typical Leakage Current vs. PIV



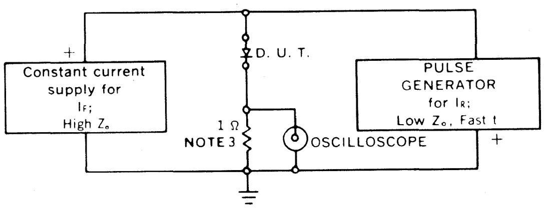
Forward Surge Current vs. Duration



Current Derating Curve

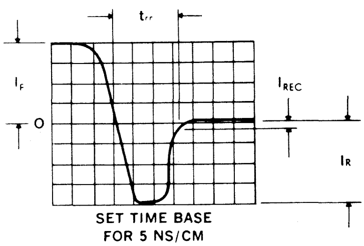


Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



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TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

SCRs
.5A, Planar

AA100-AA104
AA107-AA111
AA114-AA118

FEATURES

- Maximum Gate Trigger Current: 2, 20 or 200μA
- Tight Gate Trigger Voltage Range: .44 to .6V
- Voltage Ratings: to 400V
- Specified for dv/dt and Switching Time

DESCRIPTION

This data sheet describes Unitrode's AA Series 0.5A SCRs designed for low-current sensing applications. Units are available in a complete range of blocking voltages from 60 to 400 volts.

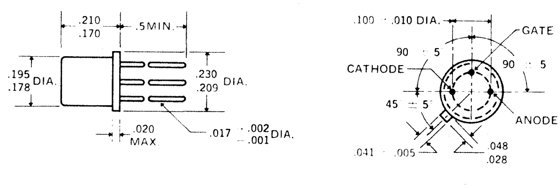
The AA100 series offers a maximum gate trigger current of 2.0 microamps making it the most sensitive device of its type. The AA107 series has a maximum I_{GT} of 20μA while this parameter is specified at 200μA for the AA114 series.

ABSOLUTE MAXIMUM RATINGS

	AA100 AA107 AA114	AA101 AA108 AA115	AA102 AA109 AA116	AA103 AA110 AA117	AA104 AA111 AA118
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	80V	150V	300V	400V	500V
Non-Repetitive Peak Off-State Voltage, V_{DSM}			500V		
D.C. On-State Current, I_T					
75°C Ambient			250mA		
100°C Case			500mA		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			5A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current, $I_{G(AV)}$			25mA		
Reverse Gate Voltage V_{GR}			6V		
Operating and Storage Temperature Range			−65°C to +150°C		

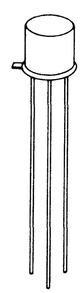
MECHANICAL SPECIFICATIONS

AA100-AA104 AA107-AA111 AA114-AA118



Dimensions in inches.

TO-18



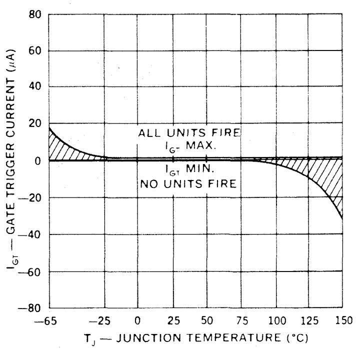
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

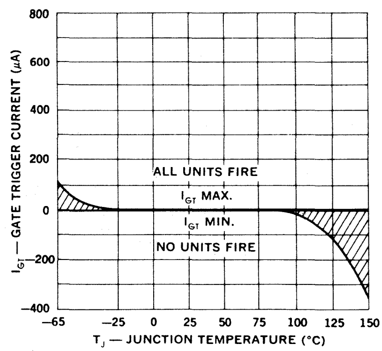
Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual & Mechanical	—	—	—	—	—	—
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.1	0.2	μA	$V_{GR} = 2V$
Gate Trigger Current	I_{GT}					$R_{GS} = 10K$, $V_D = 5V$
AA100-104		—	0.2	2.0	μA	
AA107-111		—	2.0	20	μA	
AA114-118		—	20	200	μA	
Gate Trigger Voltage	V_{GT}	0.44	0.52	0.60	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 1.0$ A (pulse)
Holding Current	I_H	0.3	0.5	2.0	mA	$R_{GK} = 1K$
SUBGROUP 3 (25°C TESTS)						
Off-State Voltage — Critical Rate of Rise	dv/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — on Pulse Width	t_{pg} (on)	—	0.5	2.0	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	20	50	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
SUBGROUP 4 (125°C TESTS)						
Off-State Current	I_{DRM}	—	10	20	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	30	100	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Gate Trigger Voltage	V_{GT}	0.15	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Holding Current	I_H	0.2	0.4	1.5	mA	$R_{GK} = 1K$

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

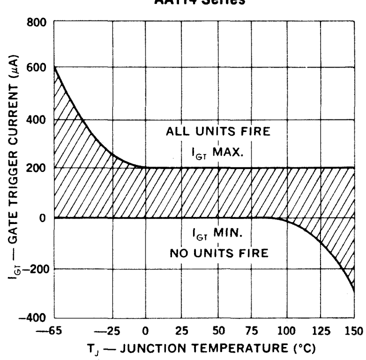
Gate Trigger Current
AA100 Series



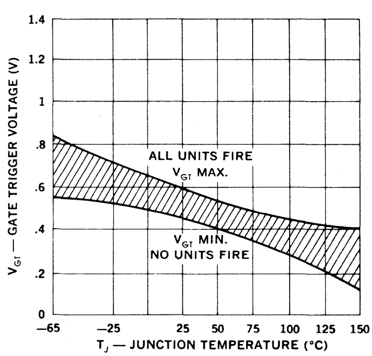
Gate Trigger Current
AA107 Series



Gate Trigger Current
AA114 Series



Gate Trigger Voltage



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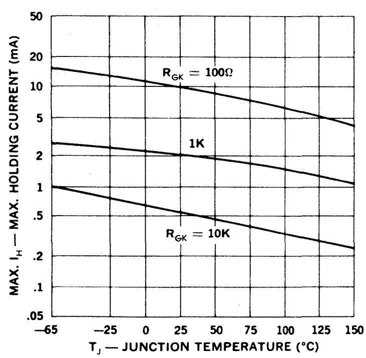
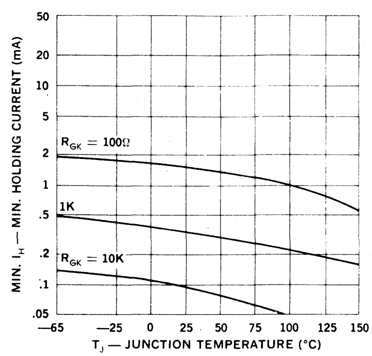
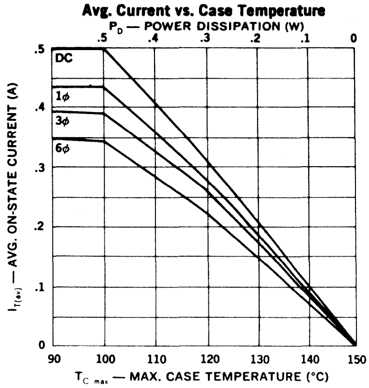
Max. Holding Current



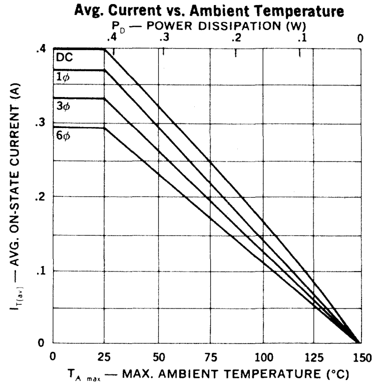
Min. Holding Current



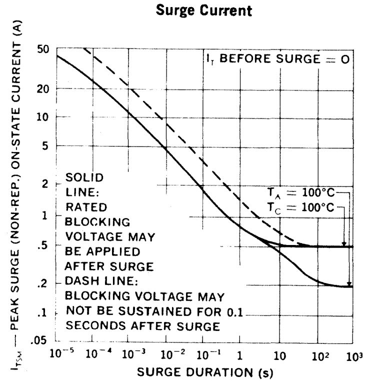
Avg. Current vs. Case Temperature



Avg. Current vs. Ambient Temperature



Surge Current



SCRs
1.6 Amp, Planar

AD100-AD104
AD107-AD111
AD114-AD118

FEATURES

- Maximum Gate Trigger Current: 2, 20 or 200μA
- Tight Gate Trigger Voltage Range: .44 to .6V
- Voltage Ratings: to 400V
- Specified for dv/dt and Switching Time

DESCRIPTION

This data sheet describes Unitrode's AD Series 1.6A SCRs designed for medium-current control and sensing applications. Units are available in a complete range of blocking voltages from 60 to 400 volts.

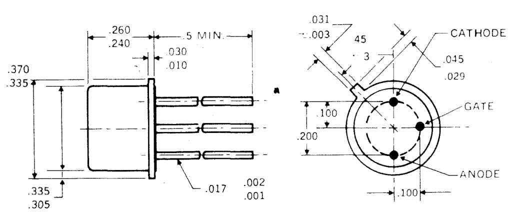
The AD100 series offers a maximum gate trigger current of 2.0 microamps making it the most sensitive device of its type. The AD107 series has a maximum I_{GT} of 20μA while this parameter is specified at 200μA for the AD114 series.

ABSOLUTE MAXIMUM RATINGS

	AD100 AD107 AD114	AD101 AD108 AD115	AD102 AD109 AD116	AD103 AD110 AD117	AD104 AD111 AD118
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM}	80V	150V	300V	400V	500V
Non-Repetitive Peak Off-State Voltage, V_{DSM}			500V		
D.C. On-State Current, I_T					
75°C Ambient			450mA		
85°C Case			1.6A		
Repetitive Peak On-State Current, I_{TRM}			up to 30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			15A		
Peak Gate Current, I_{GM}			250mA		
Average Gate Current, $I_{G(AV)}$			25mA		
Reverse Gate Voltage, V_{GR}			6V		
Operating and Storage Temperature Range			−65°C to +150°C		

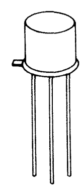
MECHANICAL SPECIFICATIONS

AD100-AD104 AD107-AD111 AD114-AD118



Dimensions in inches.

TO-39



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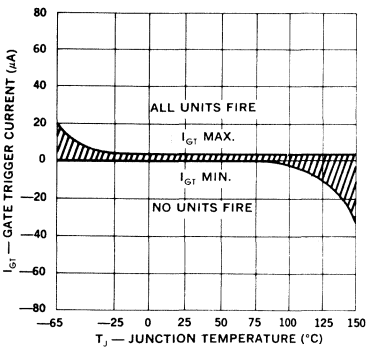
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

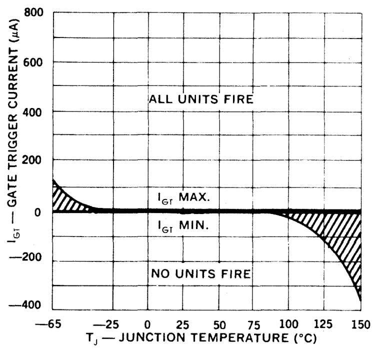
Parameter	Symbol	Min.	Typical	Max.	Units	Test Conditions
SUBGROUP 1						
Visual & Mechanical	—	—	—	—	—	
SUBGROUP 2 (25°C TESTS)						
Off-State Current	I_{DRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	.01	0.1	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	0.1	0.2	μA	$V_{GR} = 2V$
Gate Trigger Current	I_{GT}					$R_{GS} = 10K$, $V_D = 5V$
AD100-104		—	0.2	2.0	μA	
AD107-111		—	2.0	20	μA	
AD114-118		—	20	200	μA	
Gate Trigger Voltage	V_{GT}	0.44	0.52	0.60	V	$R_{GS} = 100\Omega$, $V_D = 5V$
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 1.0$ Amp (pulse)
Holding Current	I_H	0.3	0.5	2.0	mA	$R_{GK} = 1K$
SUBGROUP 3 (25°C TESTS)						
On-State Voltage-Critical Rate of Rise	dv/dt	50	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	0.5	2.0	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	0.6	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	0.4	—	μs	$I_G = 10mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_g	—	20	50	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
SUBGROUP 4 (125°C TESTS)						
Off-State Current	I_{DRM}	—	10	100	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	30	100	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Gate Trigger Voltage	V_{GT}	0.15	0.2	—	V	$R_{GS} = 100\Omega$, $V_D = 5V$
Holding Current	I_H	0.2	0.4	1.5	mA	$R_{GK} = 1K$

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

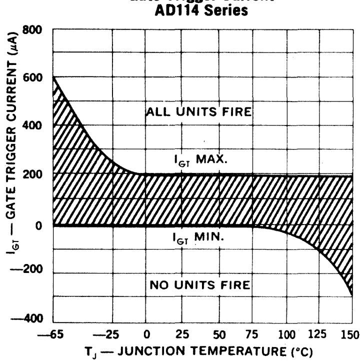
Gate Trigger Current AD100 Series



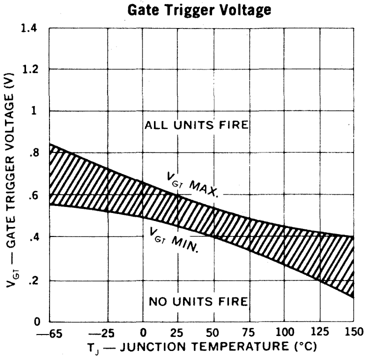
Gate Trigger Current AD107 Series

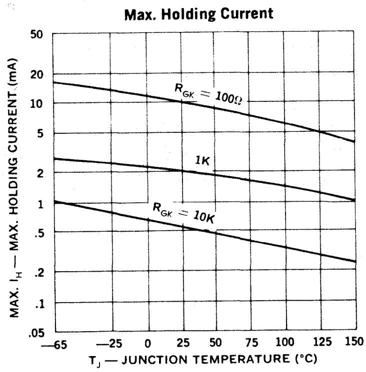


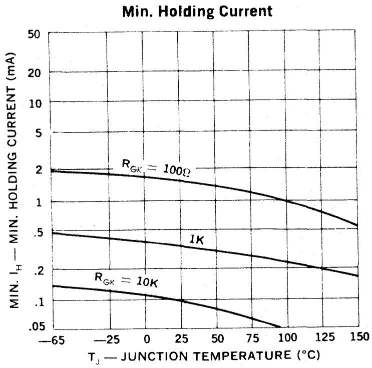
Gate Trigger Current AD114 Series

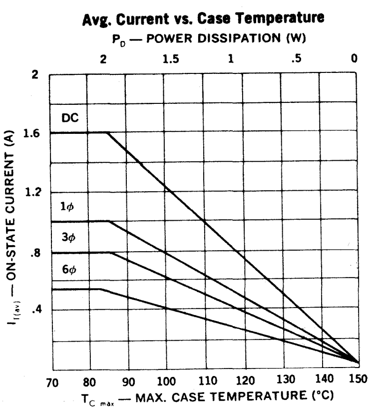


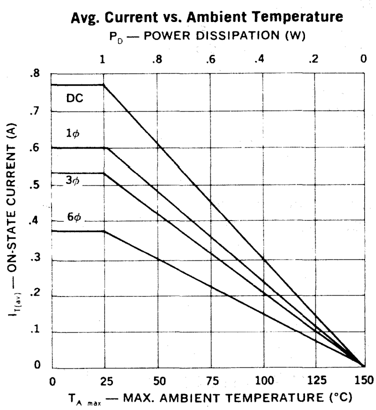
Gate Trigger Voltage

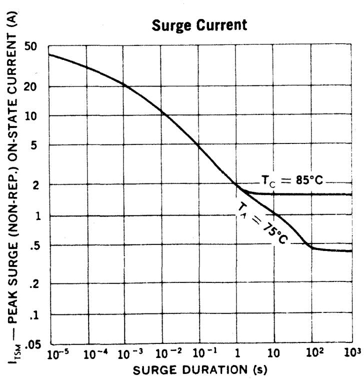



Max. Holding Current
MAX. I_H — MAX. HOLDING CURRENT (mA)
R_{GK} = 100Ω
1K
R_{GK} = 10K
T_J — JUNCTION TEMPERATURE (°C)


Min. Holding Current
MIN. I_H — MIN. HOLDING CURRENT (mA)
R_{GK} = 100Ω
1K
R_{GK} = 10K
T_J — JUNCTION TEMPERATURE (°C)


Avg. Current vs. Case Temperature
P_D — POWER DISSIPATION (W)
DC
1φ
3φ
6φ
$I_{T(av)}$ — ON-STATE CURRENT (A)
$T_{C\ max}$ — MAX. CASE TEMPERATURE (°C)


Avg. Current vs. Ambient Temperature
P_D — POWER DISSIPATION (W)
DC
1φ
3φ
6φ
$I_{T(av)}$ — ON-STATE CURRENT (A)
$T_{A\ max}$ — MAX. AMBIENT TEMPERATURE (°C)


Surge Current
I_{TSM} — PEAK SURGE (NON-REP.) ON-STATE CURRENT (A)
T_C = 85°C
T_A = 75°C
SURGE DURATION (s)

SCRs

CM100-CM104

Military/Aerospace, 5 Amp, Planar

FEATURES

- Holding Current: less than 3mA
- Turn-on Time: 0.5μs
- Maximum Gate Trigger Current: 200μa
- Specified for dv/dt
- Voltage Rating: to 400V
- Pulse Current: to 50A
- Designed for Operation −65°C to +150°C
- Available in Hermetic TO-59 Package

DESCRIPTION

Unitrode's CM 100 Series 5A SCR has been designed specifically for Military-Aerospace applications.

A unique combination of planar passivation and stud mounting in a TO-59 package enables this 5A SCR to operate with a peak recurrent forward pulse current capability of up to 50A. These devices are ideal for AC and DC switching operations, pulse modulator discharge devices, converters and inverters, and squib firing applications.

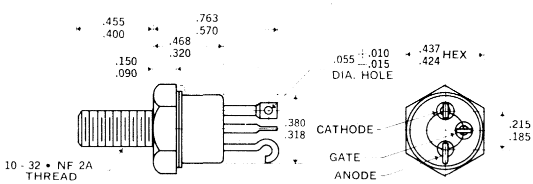
ABSOLUTE MAXIMUM RATINGS

	CM100	CM101	CM102	CM103	CM104
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	60V	100V	200V	300V	400V

D.C. On-State Current, I_T	
100°C Case	5A
Repetitive Peak On-State Current, I_{TRM}	up to 50A
Peak One Cycle Surge (non-rep) On-State Current, I_{TSM}	30A
Peak Gate Current, I_{GM}	250mA
Average Gate Current, $I_{G(AV)}$	25mA
Reverse Gate Current, I_{GR}	3mA
Reverse Gate Voltage, V_{GR}	6V
Thermal Resistance (junction to case) $R\Theta_{J-C}$	3.3°C/W
Storage Temperature Range	−65°C to +200°C
Operating Temperature Range	−65°C to +150°C

MECHANICAL SPECIFICATIONS

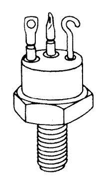
CM100-CM104



Dimensions in inches.

NOTE: Anode internally connected to case.

TO-59



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ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Max.	Units	Test Conditions
Subgroup 1 Visual & Mechanical					
Subgroup 2 (25°C Tests)					
Off-State Current	I_{DRM}	—	0.5	μA	$R_{GK} = 1K$, V_{DRM} = Rating
Reverse Current	I_{RRM}	—	0.5	μA	$R_{GK} = 1K$, V_{RRM} = Rating
Reverse Gate Current	I_{GR}	—	1.0	mA	$V_{GR} = 5V$, Anode Open
Gate Trigger Current	I_{GT}	—	200	μA	$R_{GS} = 10K$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.8	V	R_{GS} = 100 ohms; $V_D = 5V$
On-State Voltage	V_T	—	2.5	V	$I_T = 5A$, (Pulse Test)
Holding Current	I_H	0.3	3.0	mA	$R_{GK} = 1K$
Subgroup 3 (25°C Tests)					
Off-State Voltage — Critical Rate of Rise	dv/dt	100	—	V/μs	$R_{GK} = 1K$, $V_D = 30V$
Gate Trigger — On Pulse Width	t_{pg} (on)	—	0.5	μs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Delay Time	t_d	—	0.5	μs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Rise Time	t_r	—	0.5	μs	$I_G = 10mA$, $V_D = 30V$, $I_T = 1A$
Circuit Commutated Turn-off Time	t_q	—	50	μs	$I_T = 1A$, $R_{GK} = 1K$, $i_R = 1A$
Subgroup 4 (150°C Tests)					
High Temp. Off-State Current	I_{DRM}	—	200	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Reverse Current	I_{RRM}	—	300	μA	$R_{GK} = 1K$, V_{DRM} = Rating
High Temp. Gate Trigger Voltage	V_{GT}	0.15	—	V	R_{GS} = 100 ohms; $V_D = 5V$
High Temp. Holding Current	I_H	0.1	—	mA	$R_{GK} = 1K$
Subgroup 5 (—65°C Tests)					
Low Temp. Gate Trigger Voltage	V_{GT}	—	1.0	V	R_{GS} = 100 ohms; $V_D = 5V$
Low Temp. Gate Trigger Current	I_{GT}	—	1.0	mA	$R_{GS} = 10K$, $V_D = 5V$
Low Temp. Holding Current	I_H	—	5.0	mA	$R_{GK} = 1K$

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

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TRIACs

CSB20
CSB40
CSB60

25 Amp RMS, 600V, ChipStrate®
Quick Connect Terminals

FEATURES

- Voltage Ratings: 200V-600V
- Hard-Glass Passivated Junction
- Isolated Case
- Quick Connect Terminals

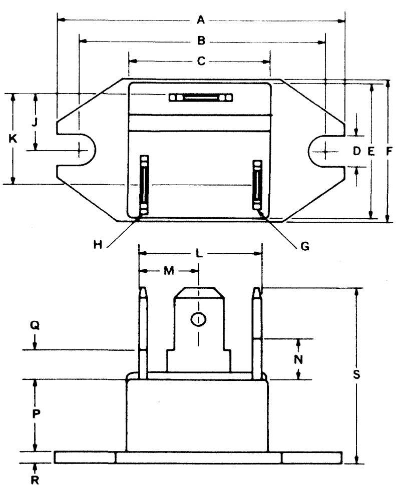
DESCRIPTION

The Unitrode ChipStrate CSB20 series Triac has been designed specifically for the appliance and industrial controls market. Standard quick connect terminals allow for simple solderless connections, ideally suited to production line techniques. The heart of this device is the exclusive ChipStrate assembly with proven reliability, incorporating a copper heat spreader, a BeO substrate for lowest thermal resistance, and a one piece lead frame construction for mechanical strength and optimum power handling capability. All Unitrode ChipStrate Triacs are isolated from the mounting flange.

ABSOLUTE MAXIMUM RATINGS

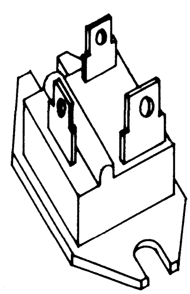
	CSB20	CSB40	CSB60
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V
On-State Current $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 360°)			25A
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}			250A
Peak Gate Power, P_{GM}			16W
Average Gate Power, $P_{G(AV)}$			0.5W
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 175mA$, $t_r = 0.1\mu s$)			125 A/μs
Storage Temperature Range			−40°C to +150°C
Operating Temperature Range			−40°C to +110°C
Isolation Voltage, Flange to Terminal			2500V RmS

CSB20
CSB40
CSB60



	DIMENSIONS	
	Ins.	mm
A	1.395	35.43
B	1.187	30.15
C	.675	17.15
D	.156 (TYP.)	3.96 (TYP.)
E	.675	17.15
F	.700	
G	.187 (.032 THICK) (GATE)	17.78 (0.81 THICK) (GATE)
H	.250 (.032 THICK) (2 PLACES)	6.35 (0.81 THICK) (GATE)
J	.290	7.37
K	.442	11.23
L	.580	14.73
M	.280	7.11
N	.218	5.54
P	.360	9.14
Q	.156 (2 PLACES)	3.96 (2 PLACES)
R	.050	1.27
S	.875 (TYPICAL)	22.23 (TYPICAL)

L3

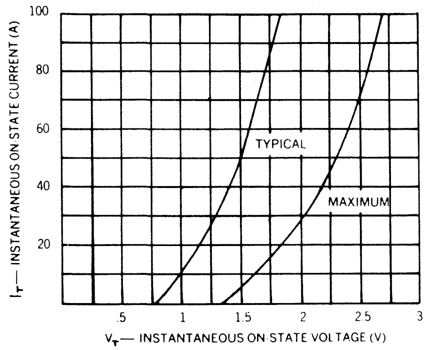


ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

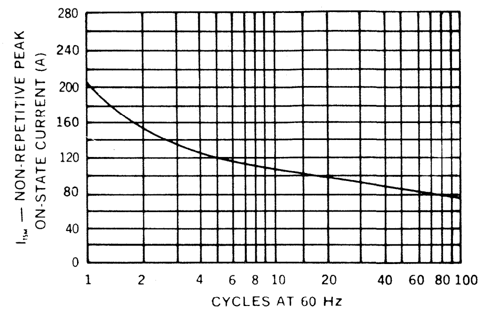
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	— —	— —	50 80	mA	V_D = 12V Quadrants 1, 3 (+ +, − −) V_D = 12V Quadrants 2, 4 (+ −, − +)
Gate Trigger Voltage	V_{GT}	—	—	2.5	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	1.9	V	I_{TM} = 28A Peak
Holding Current	I_H	—	—	50	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	20	50	—	V/μS	V_{DRM} = Rating, T_C = 100°C
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	3	10	—	V/μS	I_T = Rating, V_{DRM} = Rating, T_C = 65°C
Steady State Thermal Resistance*	$R\theta_{JC}$	—	—	1.1	°C/W	Steady State

* Junction-to-Case

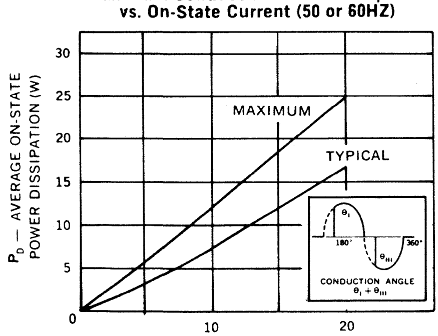
On-State Characteristics



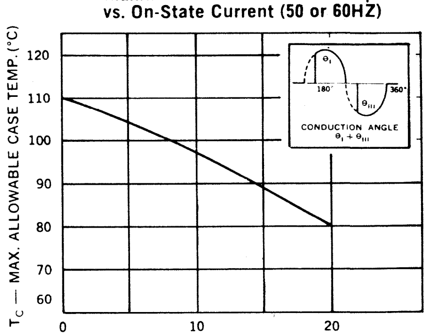
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



SCRs

Nuclear Radiation Resistant, Planar

GA100
GA101
GA102

FEATURES

- Optimized for Radiation Resistance
- Fully Characterized for "Worst Case" Design
- Post Radiation Design Limits Specified
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity
- Pulse Currents: to 30A
- Max. Trigger Current 20mA after 3 X 10^{14} NVT
- Max. Holding Current 30mA after 3 X 10^{14} NVT

DESCRIPTION

The GA100 Series of Radiation Hard SCRs have been designed to provide significantly greater radiation tolerance than conventional SCRs or Transistors with the same current handling ability. This Series is capable of operation after exposure to 10^{15} NVT.

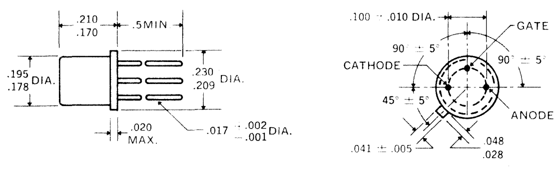
The radiation resistant characteristics of the GA100 series devices make them particularly desirable for use under radiation environments in squib firing circuits; inverters and converters; pulse generators; relay drivers; and modulator discharge switches.

ABSOLUTE MAXIMUM RATINGS

	GA100	GA101	GA102
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	80V
D.C. On-State Current, I_T			
75°C Ambient		200mA	
100°C Case		400mA	
Repetitive Peak On-State Current, I_{TRM}		up to 30A	
Surge (non-rep.) On-State Current, I_{TSM} (Sq. Pulse-50ms)		5A	
Peak Gate Current, I_{GM}		250mA	
Average Gate Current, $I_{G(AV)}$		25mA	
Reverse Gate Voltage, V_{GR}		5V	
Reverse Gate Current, I_{GR}		3mA	
Storage Temperature Range		−65°C to +200°C	
Operating Temperature Range		−65°C to +150°C	

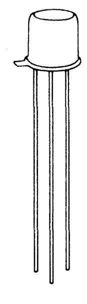
MECHANICAL SPECIFICATIONS

GA100 GA101 GA102



Dimensions in inches.

TO-18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

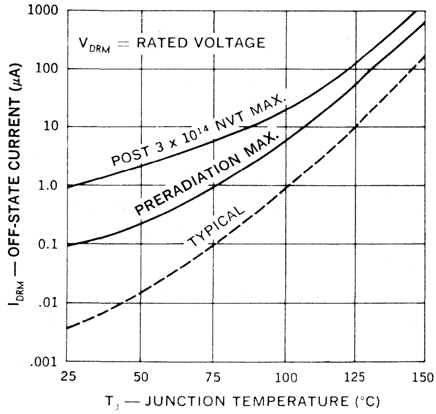
Test	Symbol	Preradiation Limits			Post 3 x 10^{14} NVT Design Limits		Units	Test Conditions
		Min.	Typ.	Max.	Min.	Max.		
SUBGROUP 1 Visual and Mechanical	—	—	—	—	—	—	—	MIL-STD-750 Method 2071
SUBGROUP 2 (25°C Tests)								
Off-State Current	I_{DRM}	—	.005	0.1	—	1.0	μA	$R_{GK} = 220\Omega$, V_{DRM} = Rating
Reverse Gate Current	I_{GR}	—	.01	0.1	—	1.0	μA	$V_{GR} = 2V$
Input Trigger Current (Note 2)	I_{ST}	1.8	2.3	3.5	—	20	mA	$R_{GK} = 220\Omega$, $V_D = 5V$
Gate Trigger Voltage	V_{GT}	0.4	0.5	0.7	—	1.5	V	$R_{GK} = 220\Omega$, $V_D = 5V$
On-State Voltage	V_T	0.8	1.1	1.5	—	3.0	V	$i_T = 1A$ (pulse test)
Holding Current	I_H	0.3	0.7	10	—	30	mA	$R_{GK} = 220\Omega$
SUBGROUP 3 (25°C Tests)								
Off-State Voltage-Critical Rate of Rise	dv_c/dt	20	40	—	—	—	V/μs	$R_{GK} = 220\Omega$, $V_D = 30V$
Gate Trigger-on Pulse Width	t_{pg} (on)	—	.02	.05	—	0.1	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Delay Time	t_d	—	.02	—	—	—	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Rise Time	t_r	—	.05	—	—	—	μs	$I_G = 25mA$, $I_T = 1A$, $V_D = 30V$
Circuit Commutated Turn-off Time	t_q	—	1.5	2.5	—	1.0	μs	$I_T = 1A$, $i_R = 1A$, $R_{GK} = 220\Omega$
SUBGROUP 4 (125°C Tests)								
High Temp Off-State Current	I_{DRM}	—	10	100	—	100	μA	$R_{GK} = 220\Omega$, V_{DRM} = Rating
High Temp Gate Trigger Voltage	V_{GT}	0.1	.17	—	0.1	—	V	$R_{GK} = 220\Omega$, $V_D = 5V$

Notes: 1. Off-State voltage ratings apply over the operating temperature range provided the gate is connected to the cathode through an appropriate resistor, or other adequate bias is used.
2. Total Input Trigger Current, including current required by 220Ω gate bias resistance.

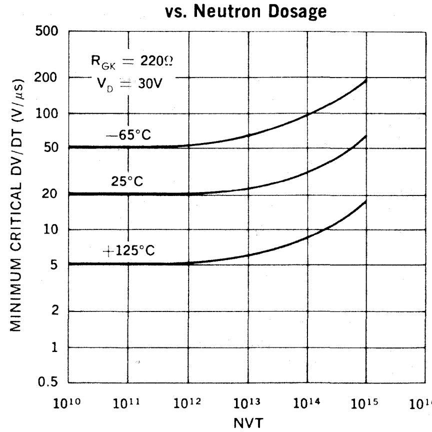
DESIGN CONSIDERATIONS

1. Curve 1 shows the off-state current, I_{DRM} of the SCR as a function of temperature. I_{DRM} is increased by radiation damage, but is not a design consideration at the recommended gate bias levels.
   In order to optimize for radiation tolerance, reverse blocking capability has not been retained as a design feature. Devices with reverse blocking capability can be provided.
2. Minimum critical dv/dt levels are defined in Curve 2. The dv/dt capability is improved after radiation because of reduced triggering sensitivity. dv/dt is therefore a design consideration only prior to radiation.
3. Curves 3 and 4 show the limits of Gate Trigger Voltage and Total Input Trigger Current prior to radiation. Maximum design limits after a total radiation dosage of 3 x 10^{14} NVT is also shown. Curves 5 and 6 show the maximum limits of Gate Trigger Voltage and Total Input Trigger Currents as a junction of neutron dosage. The minimum level of Trigger current prior to radiation is established by the shunting effect of a 220 ohm resistor between gate and cathode. After radiation the device is less sensitive and Total Trigger Current will increase to a level relatively independent of the bias resistance. The 220 ohm resistor is recommended since it raises the minimum preradiation trigger current to a level that is closer to the past radiation limit and minimizes the percentage change in this parameter.
4. Current ratings shown in Curves 10, 11, and 12 apply after the device has been subjected to 3 x 10^{14} NVT. Current ratings prior to radiation are greater than the values indicated.
5. Gamma radiation produces a reversible ionization (leakage) current within the device which is directly proportional to the Gamma flux level. When the Gamma flux level is in the range of 10 to 100 Roentgens per microsecond for burst durations greater than 1 microsecond, the device will self trigger ON. For the radiation bursts associated with nuclear explosions, the Gamma flux level will invariably cause device triggering at radiation levels significantly below the levels that would produce detectable permanent device damage due to cumulative neutron dosage. In applications where the burst effect triggering cannot be tolerated, it is necessary to reset the device after the radiation burst. Special circuit approaches such as additional SCRs to crowbar or otherwise cancel the output function may be used.

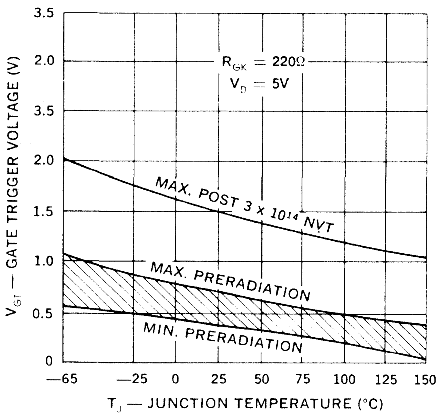
1. **Off-State Current**



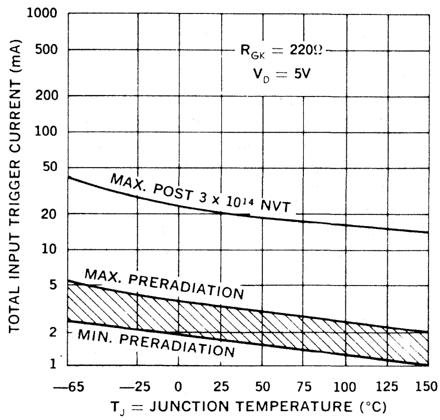
2. **Minimum Critical DV/DT vs. Neutron Dosage**



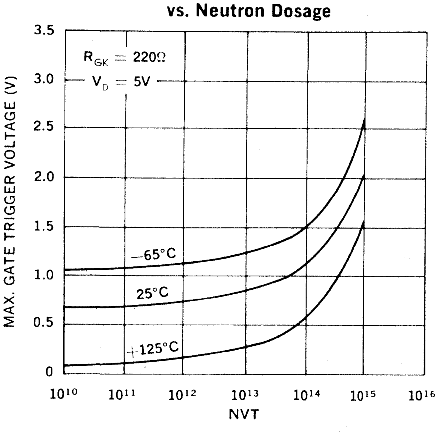
3. **Gate Trigger Voltage**



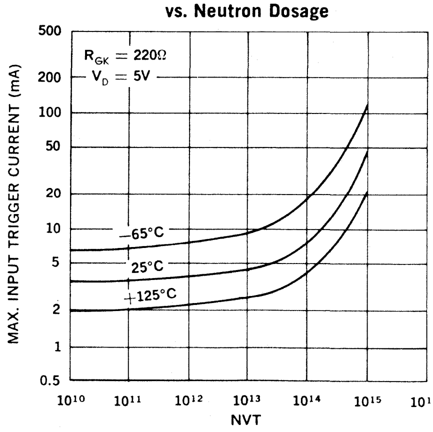
4. **Input Trigger Current**



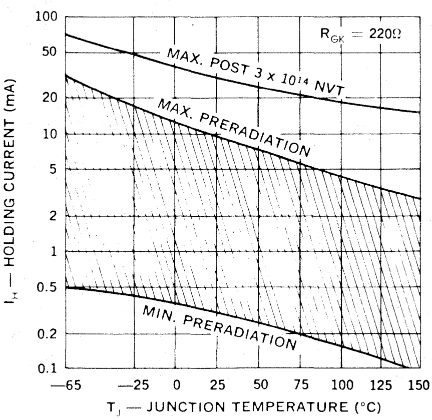
5. **Max. Gate Trigger Voltage vs. Neutron Dosage**



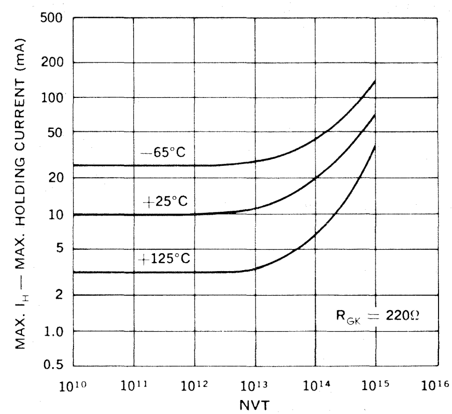
6. **Max. Input Trigger Current vs. Neutron Dosage**



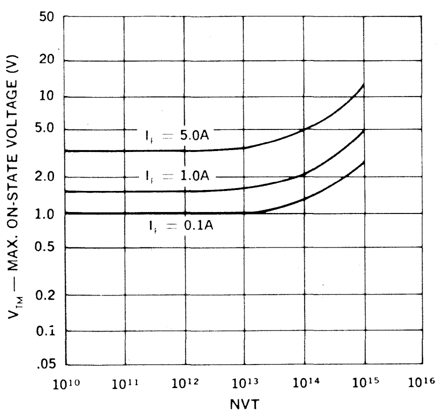
7. **Holding Current**



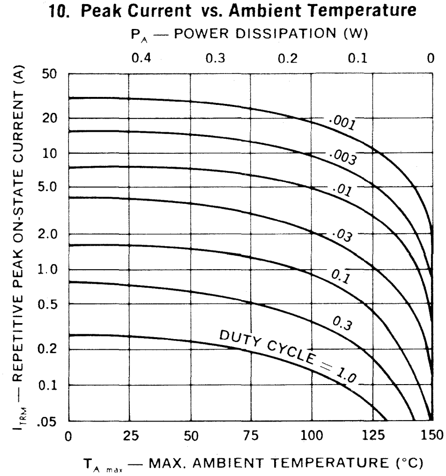
8. **Max. Holding Current vs. Neutron Dosage**



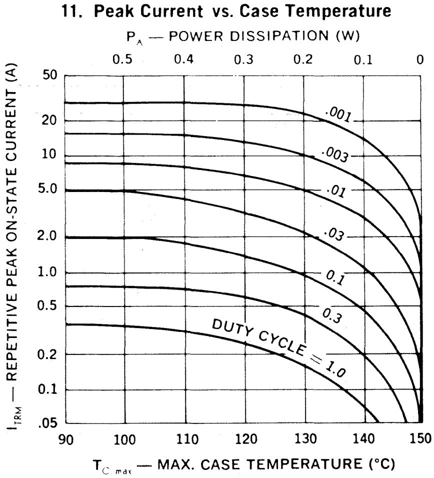
9. **Max. On-State Voltage vs. Neutron Dosage**



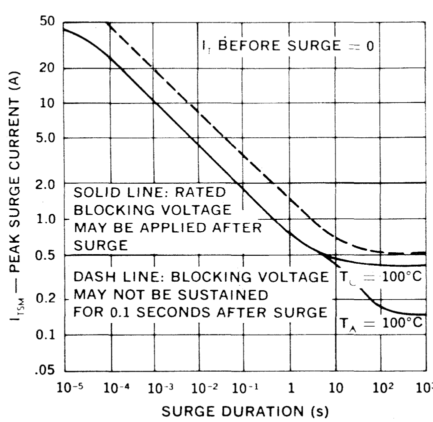
10. **Peak Current vs. Ambient Temperature**



11. **Peak Current vs. Case Temperature**



12. **Surge Current vs. Time**



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SCRs

Nanosecond Switching, Planar

GA200 GB200
GA200A GB200A
GA201 GB201
GA201A GB201A

FEATURES

- Rise Time: 10ns
- Delay Time: 10ns
- Recovery Time: 0.5 μs
- Pulse Current: to 100A
- Turn-on with 20ns, 10 mA Gate Pulse

DESCRIPTION

The Unitrode Nanosecond Thyristor Switch combines the turn-on speed of logic level transistors with the high current switching capability inherent in SCRs. With this device engineers can now design circuits capable of switching pulse currents of 1A in less than 10ns or up to 30A in less than 20ns.

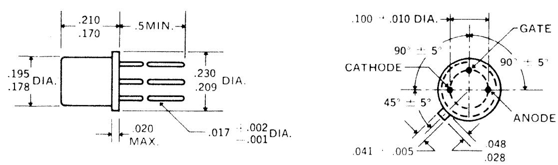
The GA/GB200 series is specifically designed for use as switching elements in high speed, low-to-medium power radar pulse modulators. Other applications include switching elements for phased array radars, laser pulse drivers, harmonic wave-form generators, line drivers and high current replacements for avalanche transistors. For applications requiring higher voltage levels, Unitrode has developed several "series string" circuits which allow the series connection of virtually an unlimited number of devices for voltages as high as 2000V with no significant decrease in speed. These circuits are described in Unitrode New Design Idea #21.

ABSOLUTE MAXIMUM RATINGS

	GA200 GA200A	GA201 GA201A	GB200 GB200A	GB201 GB201B
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	60V	100V
Repetitive Peak On-State Current, I_{TRM}	up to 100A		up to 100A	
D.C. On-State Current, I_T				
70°C Ambient	200mA		—	
70°C Case	400mA		6A	
Peak Gate Current, I_{GM}	250mA		250mA	
Average Gate Current, $I_{G(AV)}$	25mA		50mA	
Reverse Gate Current, I_{GR}	3mA		3mA	
Reverse Gate Voltage, V_{GR}	5V		5V	
Storage Temperature Range	−65°C to +200°C			
Operating Temperature Range	−65°C to +150°C			

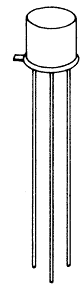
MECHANICAL SPECIFICATIONS

GA200 GA200A GA201 GA201A

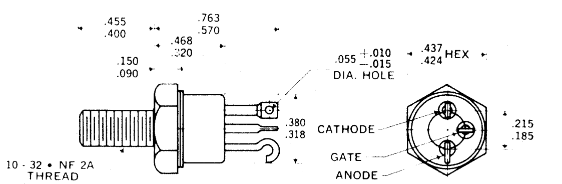


Dimensions in inches.

TO-18

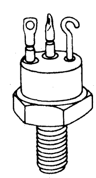


GB200 GB200A GB201 GB201A



Dimensions in inches. **NOTE:** Anode connected to case.

TO-59



UNITRODE

GA200 GA200A GA201 GA201A
GB200 GB200A GB201 GB201A

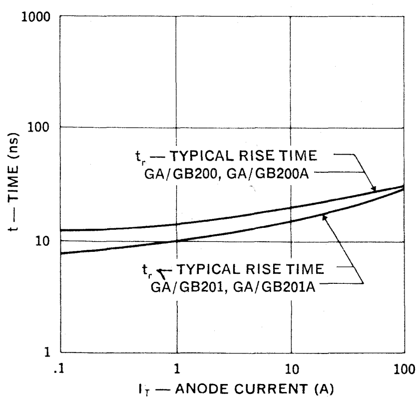
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Delay Time	t_d	—	20	30	ns	$I_G = 20mA$, $I_T = 1A$
		—	10	—	ns	$I_G = 30mA$, $I_T = 1A$
Rise Time GA200, 200A, GB200, 200A	t_r	—	15	25	ns	$V_D = 60V$, $I_T = 1A$ (1)
		—	25	—	ns	$V_D = 60V$, $I_T = 30A$ (1)
Rise Time GA201, 201A, GB201, 201A	t_r	—	10	20	ns	$V_D = 100V$, $I_T = 1A$ (1)
		—	20	—	ns	$V_D = 100V$, $I_T = 30A$ (1)
Gate Trigger on Pulse Width	$t_{pg(on)}$	—	.02	.05	μs	$I_G = 10mA$, $I_T = 1A$
Circuit Commutated Turn-off Time GA200, 201, GB200, 201	t_q	—	0.8	2.0	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
GA200A, 201A, GB200A, 201A	t_q	—	0.3	0.5	μs	
Off-State Current	I_{DRM}	—	.01	0.1	μA	V_{DRM} = Rating, $R_{GK} = 1K$
		—	20	100	μA	V_{DRM} = Rating, $R_{GK} = 1K$, 150°C
Reverse Current	I_{RRM}	—	1.0	10	mA	$V_{RRM} = 30V$, $R_{GK} = 1K$ (2)
Reverse Gate Current	I_{GR}	—	.01	0.1	mA	$V_{GRM} = 5V$
Gate Trigger Current	I_{GT}	—	10	200	μA	$V_D = 5V$, $R_{GS} = 10K$
Gate Trigger Voltage	V_{GT}	0.4	.06	0.75	V	$V_D = 5V$, $R_{GS} = 100\Omega$, T = 25°C
		0.10	0.2	—	V	T = +150°C
On-State Voltage	V_T	—	1.1	1.5	V	$I_T = 2A$
Holding Current	I_H	0.3	2.0	5.0	mA	$V_D = 5V$, $R_{GS} = 100\Omega$, T = 25°C
		0.05	0.2	—	mA	T = +150°C
Off-State Voltage-Critical Rate of Rise	dv/dt	20	40	—	V/μs	$V_D = 30V$, $R_{GK} = 1K$

Notes: 1. I_G = 10mA; Pulse Test, Duty Cycle <1%.

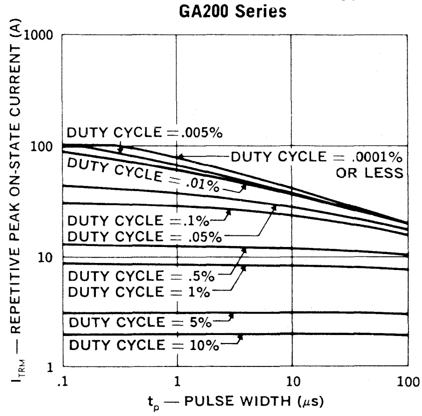
2. Pulse test intended to guarantee reverse anode voltage capability for pulse commutation. Device should not be operated in the Reverse blocking mode on a continuous basis.

Switching Speed (Typical)
GA/GB200 Series



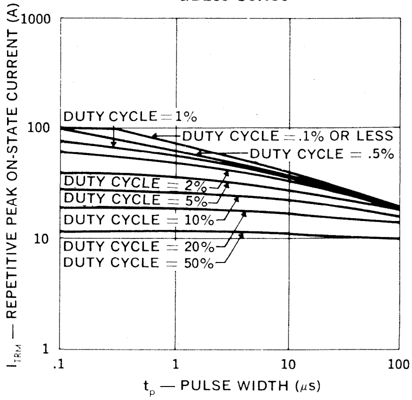
NOTES: 1. V_D = Rated V_{DRM}
2. T_A = 25°C
3. I_G = 20mA
4. t_d = 20ns TYPICALLY FOR ALL TYPES INDEPENDENT OF ANODE CURRENT

Peak Current vs. Pulse Width
GA200 Series



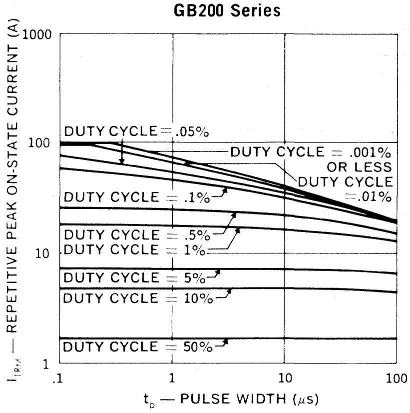
NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT T_j = 150°C. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. T_A = 75°C

Peak Current vs. Pulse Width
GB200 Series



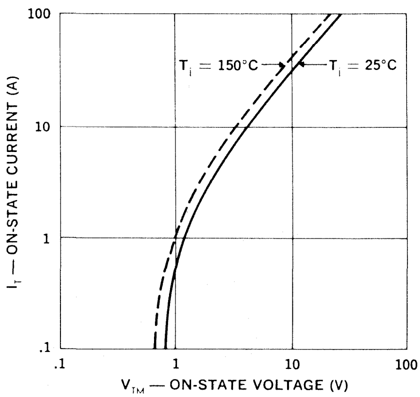
NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT $T_j = 150°C$. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. $T_C = 75°C$

Peak Current vs. Pulse Width
GB200 Series

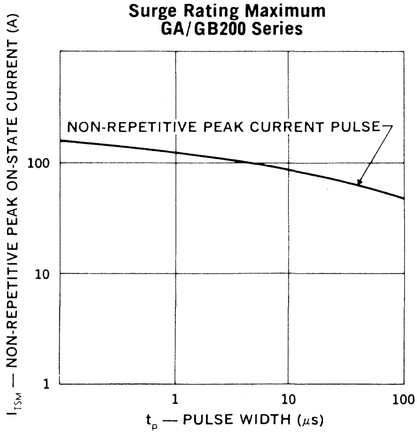


NOTES: 1. DATA BASED ON ON-STATE VOLTAGE GRAPH AT $T_j = 150°C$. BLOCKING VOLTAGE MAY BE APPLIED IMMEDIATELY AFTER TERMINATION OF CURRENT PULSE.
2. $T_A = 75°C$

On-State Current vs. Voltage
GA/GB200 Series



Surge Rating Maximum
GA/GB200 Series



NOTES: 1. BLOCKING VOLTAGE MAY NOT BE APPLIED FOR .001 SEC. AFTER TERMINATION OF SURGE PULSE AS JUNCTION TEMPERATURE WILL EXCEED 150°C.
2. $T_C = 75°C$

SCRs

Nanosecond Switching, Planar

GA300 GA300A GA301 GA301A GB300 GB300A GB301 GB301A

FEATURES

- Rise Time: 10ns
- Delay Time: 10ns
- Recovery Time: 0.5μs
- Pulse Current: to 100A
- Turn-on with 20ns, 10mA gate pulse

DESCRIPTION

Unitrode's Nanosecond Thyristor Switch combines the turn-on speed of logic level transistors with the high current switching capability inherent in SCRs. With this device, engineers can now design circuits capable of switching pulse currents of 1A in less than 10ns or up to 30A in less than 20ns.

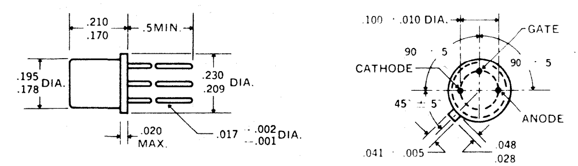
The GA300, GB300 Series is specifically designed for use as the switching element in high speed laser diode pulse drivers. Other applications include electronic crowbars, harmonic wave-form generators, line drivers and general purpose replacements for avalanche transistors. For applications requiring higher voltage levels, Unitrode has developed several "series string" circuits which allow the series connection of an unlimited number of devices for voltages as high as 2000V with no significant decrease in speed. These circuits are described in Unitrode's New Design Idea #21.

ABSOLUTE MAXIMUM RATINGS

	GA300 GA300A	GA301 GA301A	GB300 GB300A	GB301A GB301
Repetitive Peak Off-State Voltage, V_{DRM}	60V	100V	60V	100V
Repetitive Peak On-State Current, I_{TRM}	up to 100A		up to 100A	
Peak Gate Current, I_{GM}	250mA		250mA	
Average Gate Current, $I_{G(AV)}$	25mA		50mA	
Reverse Gate Current, I_{GR}	3mA		3mA	
Reverse Gate Voltage, V_{GR}	5V		5V	
Storage Temperature Range	−65°C to +150°C			
Operating Temperature Range	0°C to +125°C			

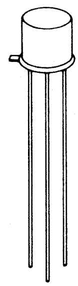
MECHANICAL SPECIFICATIONS

GA300 GA300A GA301 GA301A

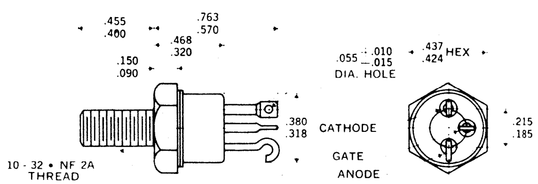


Dimensions in inches.

TO-18

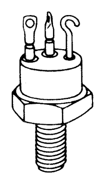


GB300 GB300A GB301 GB301A



Dimensions in inches. **NOTE:** Anode connected to case.

TO-59



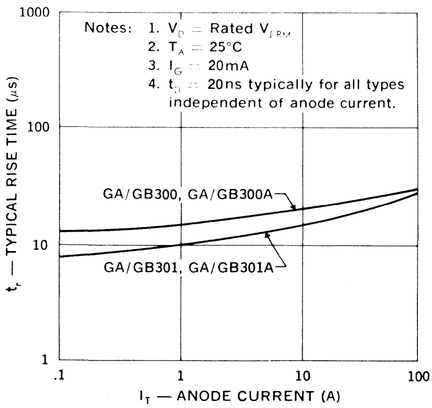
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

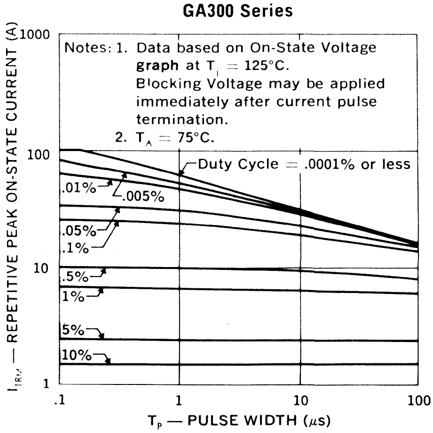
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Delay Time	t_d	—	20 10	30 —	ns	$I_G = 20mA$, $I_T = 1A$ $I_G = 30mA$, $I_T = 1A$
Rise Time (Note 1) GA300, 300A, GB300, 300A	t_r	—	15 25	25 —	ns	$V_D = 60V$, $I_T = 1A$ $V_D = 60V$, $I_T = 30A$ (Note 1)
Rise Time (Note 1) GA301, 301A, GB301, 301A	t_r	—	10 20	20 —	ns	$V_D = 100V$, $I_T = 1A$ $V_D = 100V$, $I_T = 30A$ (Note 1)
Circuit Commutated Turn-off Time GA300, 301, GB300, 301	t_q	—	0.8	2.0	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
GA300A, 301A, GB300A, 301A			0.3	0.5	μs	$I_T = 1A$, $I_R = 1A$, $R_{GK} = 1K$
Gate Trigger-on Pulse Width	$t_{pg\,(on)}$	—	0.02	0.05	μs	$I_G = 10mA$, $I_T = 1A$
Off-state Current	I_{DRM}	— —	0.01 20	0.1 100	μA μA	V_{DRM} = Rating, $R_{GK} = 1K$, $T = 25°C$ V_{DRM} = Rating, $R_{GK} = 1K$, $T = 125°C$
Reverse Current (Note 2)	I_{RRM}	—	1.0	10	mA	$V_{RRM} = 30V$, $R_{GK} = 1K$ (Note 2)
Gate Trigger Voltage	V_{GT}	0.4 0.10	0.6 0.2	0.75 —	V V	$V_D = 5V$, $R_{GS} = 100\Omega$, $T = 25°C$ $V_D = 5V$, $R_{GS} = 100\Omega$, $T = 125°C$
Gate Trigger Current	I_{GT}	—	10	200	μA	$V_D = 5V$, $R_{GS} = 10K$
On-state Voltage	V_T	—	1.1	1.5	V	$I_T = 2A$
Off-state Voltage — Critical Rate of Rise	dv/dt	15	30	—	$V/\mu s$	$V_D = 30V$, $R_{GK} = 1K$
Reverse Gate Current	I_{GR}	—	0.01	0.1	mA	$V_{GR} = 5V$
Holding Current	I_H	0.3 0.05	2.0 0.4	5.0 —	mA mA	$V_D = 5V$, $R_{GK} = 1K$, $T = 25°C$ $V_D = 5V$, $R_{GK} = 1K$, $T = 125°C$

Notes: 1. $I_G = 10mA$; Pulse Test, Duty Cycle $< 1\%$.
2. Pulse test intended to guarantee reverse anode voltage capability for pulse commutation. Device should not be operated in the reverse blocking mode on a continuous basis.

Switching Speed vs. Current
GA/GB300 Series



Peak Current vs. Pulse Width
GA300 Series



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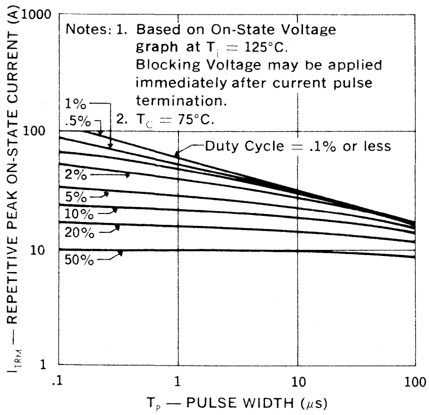
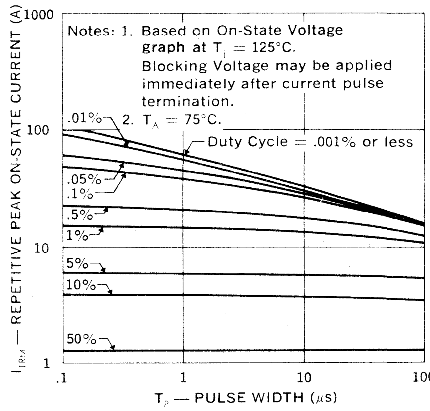
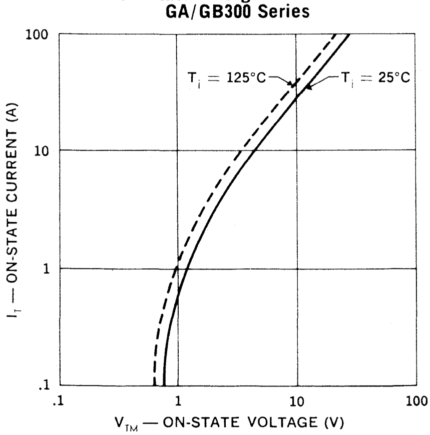
**Peak Current vs. Pulse Width
GB300 Series**



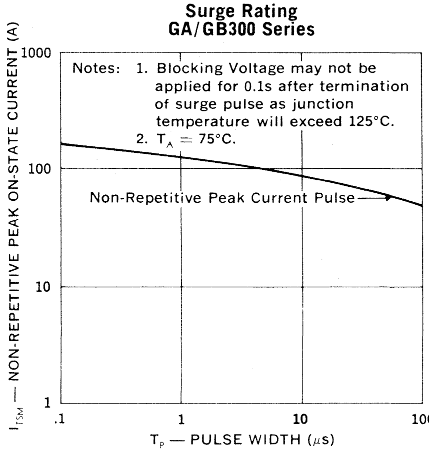
**Peak Current vs. Pulse Width
GB300 Series**



**On-State Voltage vs. Current
GA/GB300 Series**



**Surge Rating
GA/GB300 Series**



SCRs

.5 Amp, Planar

FEATURES

- Voltage Ratings: to 400V
- Maximum Gate Trigger Current: 200μA
- Hermetically Sealed TO-18 Metal Can
- Planar Passivated Construction

DESCRIPTION

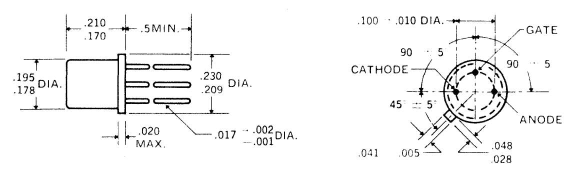
This Data Sheet describes Unitrode's line of hermetically sealed industrial SCRs designed for low-voltage, low-current sensing application. The ID 100 Series is packaged in a TO-18 metal case with Unitrode's unique oxide passivated junctions, offering the highest degree of reliability and parameter stability for any device in its price range.
Typical applications include lamp driving, relay driving, sensor, pulse-generating and timing circuits.

ABSOLUTE MAXIMUM RATINGS

	ID100	ID101	ID102	ID103	ID104	ID105	ID106
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V	300V	400V
On-State Current, I_T.							
75°C Ambient	250mA						
100°C Case	0.5A						
Repetitive Peak On-State Current, I_{TRM}	6A						
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	up to 30A						
Peak Gate Current, I_{GM}	250mA						
Average Gate Current, $I_{G(AV)}$	25mA						
Reverse Gate Voltage, V_{GR}	6V						
Storage Temperature Range	−65°C to +150°C						
Operating Temperature Range	−65°C to +125°C						

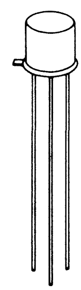
MECHANICAL SPECIFICATIONS

ID100-ID106



Dimensions in inches.

TO-18



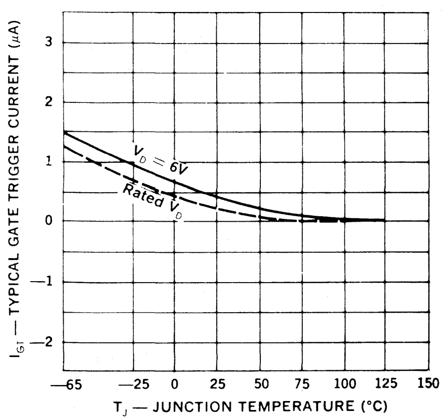
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

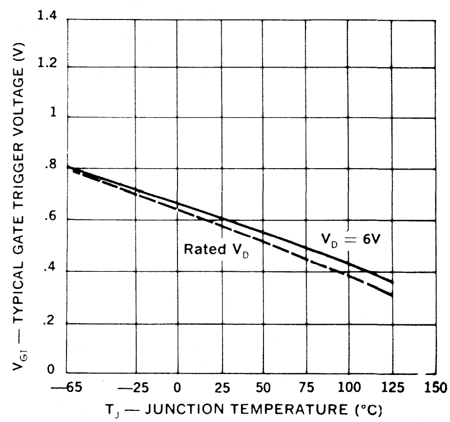
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	5.0	50	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, ID100-ID104
		—	10.0	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, ID105-ID106
Reversing Current	I_{RRM}	—	10	50	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, ID100-ID104
		—	15	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, ID105-ID106
Gate Trigger Current	I_{GT}	—	5.0	200	μA	V_D = 5V, R_{GS} = 10K
		—	—	500	μA	V_D = 5V, R_{GS} = 10K, T = −40°C
Gate Trigger Voltage	V_{GT}	0.4	0.55	0.8	V	V_D = 5V, R_{GS} = 100Ω
		—	—	1.0	V	V_D = 5V, R_{GS} = 100Ω, T = −40°C
		0.10	—	—	V	V_D = 5V, R_{GS} = 100Ω, T = 125°C
Peak On-State Voltage	V_{TM}	—	—	1.7	V	I_{TM} = 1 Amp Pulse
Holding Current	I_H	—	1.0	5.0	mA	R_{GK} = 1K
		—	—	10.0	mA	R_{GK} = 1K, T = −40°C
Turn-on Time	t_{on}	—	0.5	—	μs	I_G = 10mA, I_T = 1A, V_D = 30V
Circuit Commutated Turn-off Time	t_q	—	8.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, ID100-ID104
		—	15.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, ID105-ID106

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

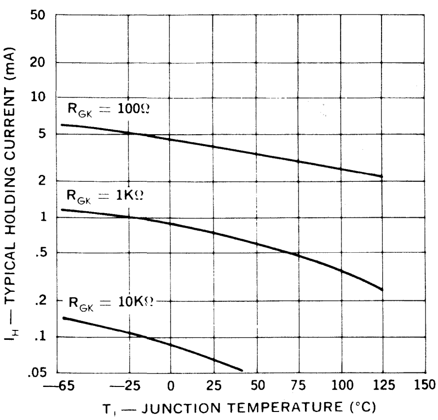
Gate Trigger Current vs. Junction Temp.



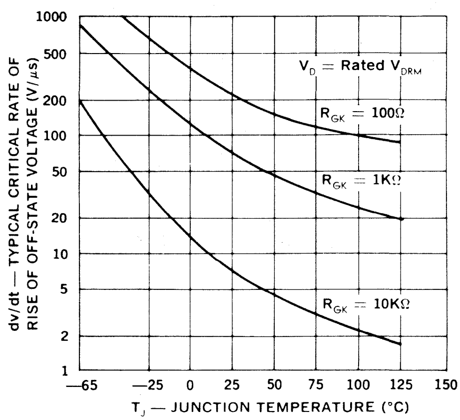
Gate Trigger Voltage vs. Junction Temp.



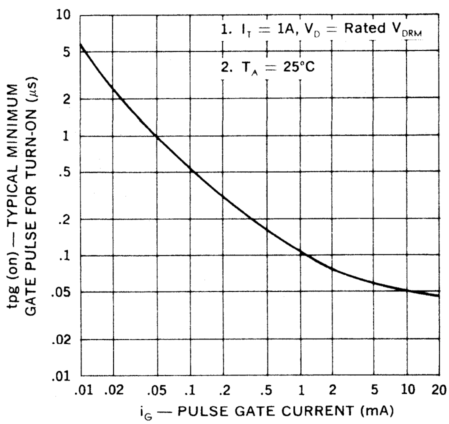
Holding Current vs. Junction Temp.



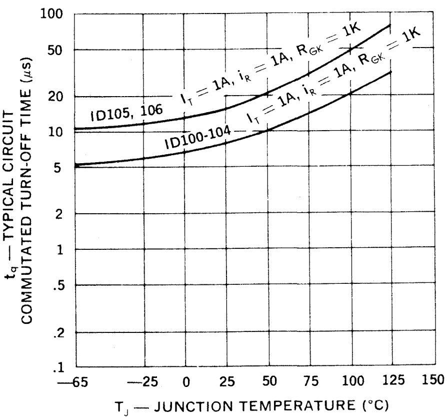
dv/dt vs. Junction Temp.



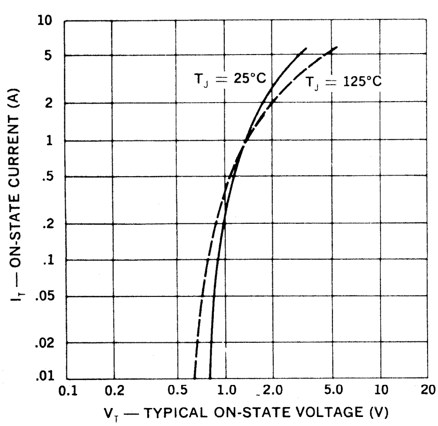
Gate Pulse for Turn-On vs. Pulse Gate Current



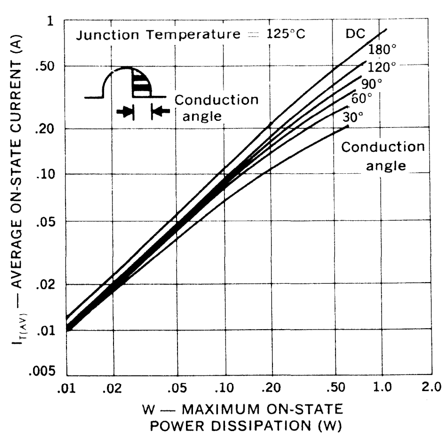
Circuit Commutated Turn-Off Time vs. Junction Temp.



Current vs. On State Voltage



Current vs. Power Dissipation



SCRs
1.6 Amp, Planar

ID200-ID203
ID300-ID301

FEATURES
- Voltage Rating: to 200V
- Max. Gate Trigger Current: 200μA
- Hermetically Sealed Metal Can
- Planar Passivated Construction

DESCRIPTION

This Data Sheet describes Unitrode's line of hermetically sealed industrial SCRs designed for high-voltage, medium-current control applications. The Series is packaged in a TO-39 metal case with Unitrode's unique oxide passivated junctions to ensure reliability and parameter stability.

Typical applications include relay equipment, motor controls, process controllers and pulse generators.

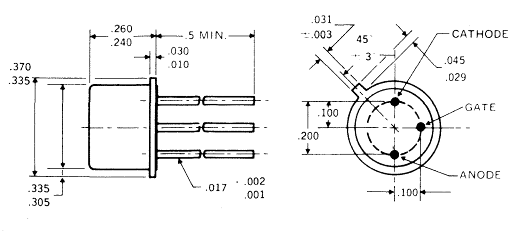
ABSOLUTE MAXIMUM RATINGS

	ID200	ID201	ID202	ID203	ID300	ID301
Repetitive Peak Off-State Voltage, V_{DRM}	50V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	50V	100V	150V	200V	300V	400V
Non-Repetitive Peak Reverse Voltage, V_{RSM} (<5ms)	75V	150V	225V	300V	400V	500V

On-State Current, $I_{T(RMS)}$	
70°C Case	1.6A
75°C Ambient	450mA
Peak One Cycle Surge (Non-Repetitive) On-State Current, I_{TSM}	15A
Repetitive Peak On-State Current, I_{TRM}	up to 30A
Rate of Rise of On-State Current, di/dt	100A/μs
I^2t (for times > 1.5 ms)	0.83A^2s
Peak Gate Current, I_{GM}	250mA
Average Gate Current, $I_{G(AV)}$	25mA
Reverse Gate Voltage, V_{GR}	6V
Storage Temperature Range	−65°C to +150°C
Operating Temperature Range	−40°C to +110°C

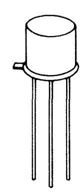
MECHANICAL SPECIFICATIONS

ID200-ID203 ID300-ID301



Dimensions in inches.

TO-39



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typ.	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	10	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 25°C
		—	5	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 110°C
Reverse Current	I_{RRM}	—	—	10	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 25°C
		—	10	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 110°C
Gate Trigger Current	I_{GT}	—	—	200	μA	V_D = 5V, R_{GS} = 10K, T = 25°C
		—	—	500	μA	V_D = 5V, R_{GS} = 10K, T = —40°C
On-State Voltage	V_{GT}	0.4	0.52	0.8	V	V_D = 5V, R_{GS} = 100Ω, T = 25°C
		0.5	0.7	1.0	V	V_D = 5V, R_{GS} = 100Ω, T = —40°C
		0.2	—	—	V	V_D = 5V, R_{GS} = 100Ω, T = 110°C
Peak On — Voltage	V_{TM}	—	—	2.2	V	I_T = 4 Amp Pulse, T = 25°C
Holding Current	I_H	0.3	0.7	3.0	mA	R_{GK} = 1K, T = 25°C
		0.4	—	6.0	mA	R_{GK} = 1K, T = —40°C
		0.2	—	—	mA	R_{GK} = 1K, T = 110°C
Off-State Voltage — Critical Rate of Rise	dv/dt	—	20	—	V/μs	V_{DRM} = Rated, R_{GK} = 1K, T = 110°C
Turn-on Time	t_{on}	—	1.0	—	μs	I_G = 10mA, I_T = I_A, V_D = 30V, T = 25°C
Circuit Commutated Turn-off Time	t_q	—	—	40	μs	I_T = i_R = 1A, R_{GK} = 1K, T = 25°C

Note: Blocking voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through a resistor, 1000 ohms or smaller, or other adequate bias is used.

SCRs

.8 Amp RMS, Plastic

IP100-IP106

FEATURES

- Voltage Ratings: to 400V
- Forward Current: 0.8A RMS
- Surge Current: 6A, 8 ms
- Gate Sensitivity: 200 μA max.
- Planar Passivated Process
- TO-92 Plastic Package

DESCRIPTION

This plastic series features very fast switching performance, low forward voltage drop and a high degree of reliability and parameter stability. All units are fully planar passivated and are packaged in a rugged TO-92 case, constructed from a special epoxy compound that features excellent moisture resistance providing stable performance under high humidity conditions and good thermal transfer characteristics.

TYPICAL APPLICATIONS

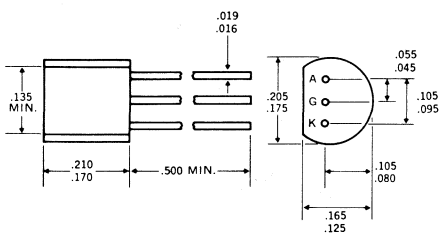
Lamp Driving	Process Controls	Remote Controls
Relay Driving	Pressure Controls	High Current SCR Driving
Relay Replacement	Display Systems	Timers
Alarm Systems	Touch Switches	Temperature Controls
Counters	and many other current sensing and control applications.	

ABSOLUTE MAXIMUM RATINGS

	IP100	IP101	IP102	IP103	IP104	IP105	IP106
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	150V	200V	300V	400V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	150V	200V	300V	400V
On-State Current, I_T				0.8A			
Surge (Non-Rep.) On-State Current, I_{TSM}				6A			
Peak Gate Current, I_{GM}				1.0A			
Peak Gate Power, P_{GM}				1W			
Average Gate Power, P_G (Av.)				0.01W			
Reverse Gate Voltage, V_{GR}				6V			
Storage Temperature Range				−65°C to +150°C			
Operating Temperature Range				−65°C to +125°C			

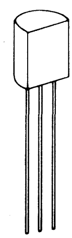
MECHANICAL SPECIFICATIONS

IP100-IP106



Dimensions in inches.

TO-92



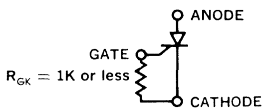
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

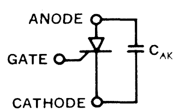
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	0.1	1.0	μA	V_{DRM} = Rating, R_{GK} = 1K
		—	—	50	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, IP100-IP104
		—	—	100	μA	V_{DRM} = Rating, R_{GK} = 1K, T = 125°C, IP105, IP106
Reverse Current	I_{RRM}	—	0.1	1.0	μA	V_{RRM} = Rating, R_{GK} = 1K
		—	—	50	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, IP100-IP104
		—	—	100	μA	V_{RRM} = Rating, R_{GK} = 1K, T = 125°C, IP105, IP106
Gate Trigger Current	I_{GT}	—	0.4	200	μA	V_D = 6V, R_{GS} = 10K,
		—	—	500	μA	V_D = 6V, R_{GS} = 10K, T = −65°C
Gate Trigger Voltage	V_{GT}	—	0.6	0.8	V	V_D = 6V, R_{GS} = 100Ω
		—	—	1.0	V	V_D = 6V, R_{GS} = 100Ω, T = −65°C
		0.1	—	—	V	V_D = 6V, R_{GS} = 100Ω, T = 125°C
Peak On-State Voltage	V_{TM}	—	1.2	1.7	V	I_{TM} = 1 Amp Pulse
Holding Current	I_{HX}	—	0.7	5.0	mA	R_{GK} = 1K, T = 25°C
		—	—	10.0	mA	R_{GK} = 1K, T = −65°C
Critical Rate of Rise — Off-State Voltage	dv/dt	—	75	—	V/μs	V_D = Rating, R_{GK} = 1K,
Turn-on Time	t_{on}	—	0.1	—	μs	I_G = 10mA, I_T, = 1A, V_D = 30V, IP100-IP104
		—	0.5	—	μs	I_G = 10mA, I_T, = 1A, V_D = 30V, IP105, IP106
Circuit Commutated Turn-off Time	t_q	—	8.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, IP100-IP104
		—	15.0	—	μs	I_T = I_R = 1A, R_{GK} = 1K, IP105, IP106

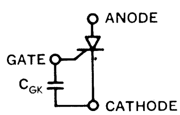
DESIGN CONSIDERATIONS

1. The IP100 Series SCRs are guaranteed to block their rated voltage over their rated operating temperature when a resistance of 1000 ohms or less is connected from gate to cathode as shown.

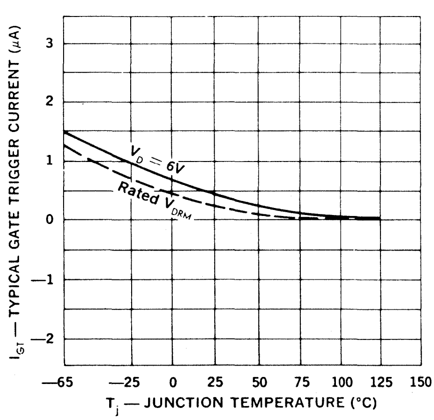


2. In cases where the SCR may be subjected to fast rising anode voltages a capacitor can be connected between anode or gate and cathode as shown, to serve as protection against dv/dt firing.

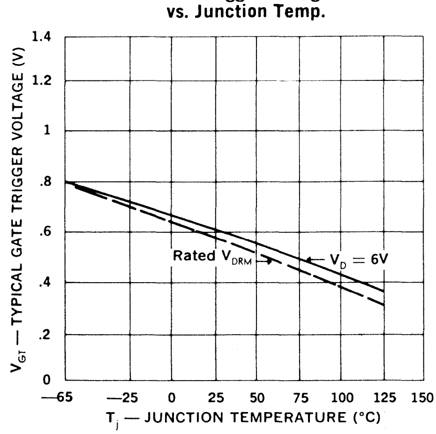




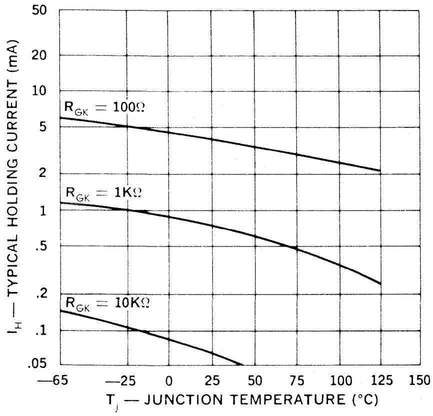
Gate Trigger Current vs. Junction Temp.



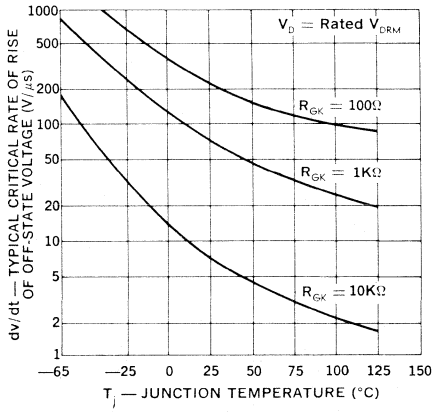
Gate Trigger Voltage vs. Junction Temp.



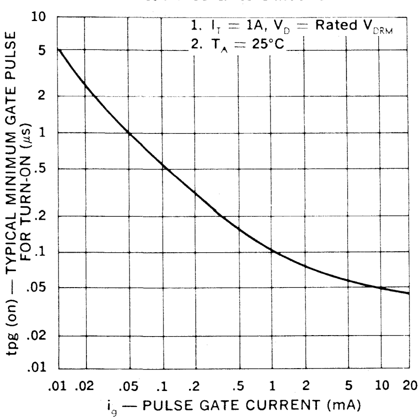
Holding Current vs. Junction Temp.



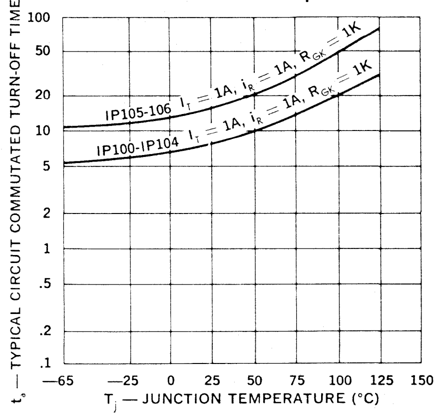
dv/dt vs. Junction Temp.



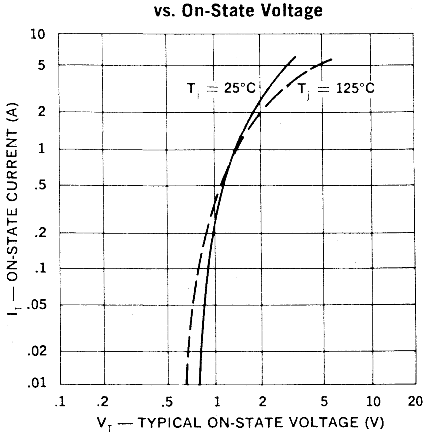
Gate Pulse For Turn-On vs. Pulse Gate Current



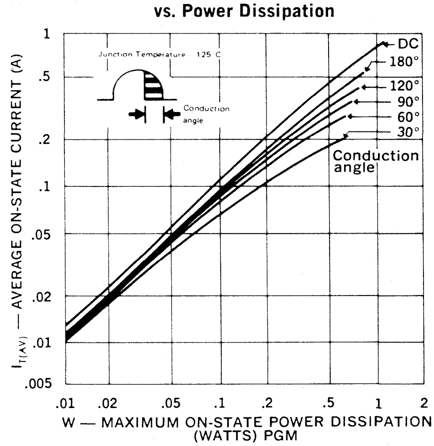
Circuit Commutated Turn-Off Time vs. Junction Temp.



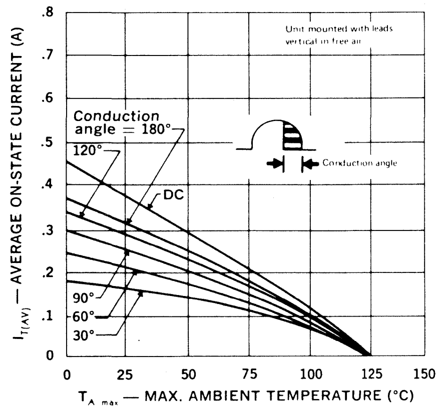
Current vs. On-State Voltage



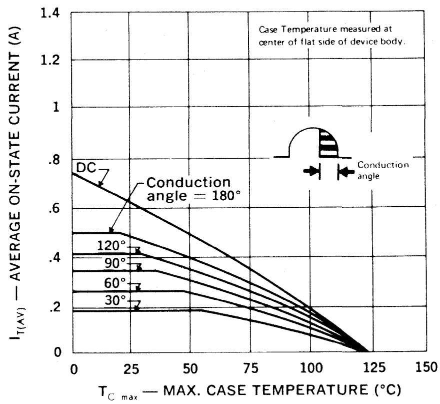
Current vs. Power Dissipation



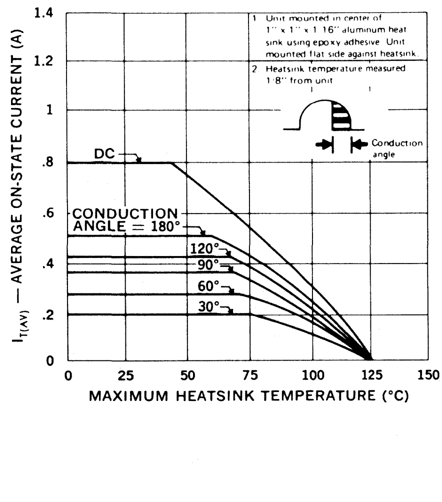
Current vs. Ambient Temp.



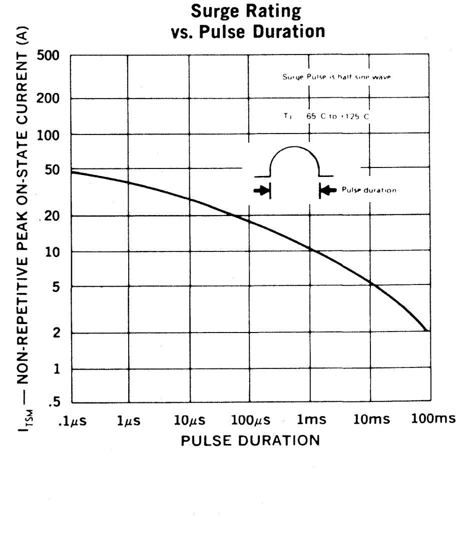
Current vs. Case Temp.



Current vs. Heatsink Temp.



Surge Rating vs. Pulse Duration



TRIACs
30 Amp RMS, 800V, ChipStrate®

L1BO4302F
L1BO4304F
L1BO4306F
L1BO4308F

FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

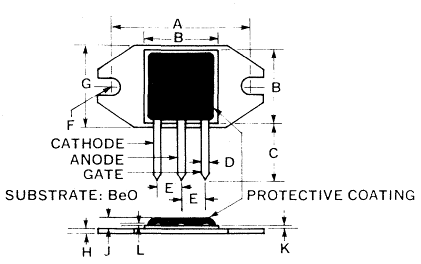
DESCRIPTION
Unitrode ChipStrate power Triacs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

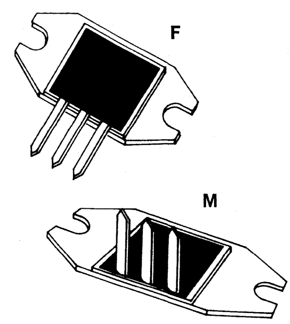
	L1BO4302F	L1BO4304F	L1BO4306F	L1BO4308F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
On-State Current $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 360°)		30A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}		300A		
Peak Gate Power, P_{GM}		40W		
Average Gate Power, $P_{G(AV)}$		.75W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 200mA$, $t_r = .1\mu s$)		150 A/μs		
Storage Temperature Range		—40°C to +150°C		
Operating Temperature Range		—40°C to +110°C		

MECHANICAL SPECIFICATIONS

L1BO4302F L1BO4304F L1BO4306F L1BO4308F



L1 with Flange		
	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.650	16.51
C	.500 NOM.	12.70 NOM.
D	.060	1.53
E	.200	5.08
F	.078 R. TYP.	.20 R. TYP.
G	.690 – .710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51



PART NO. SUFFIX: When ordering, specify correct part number suffix.

F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

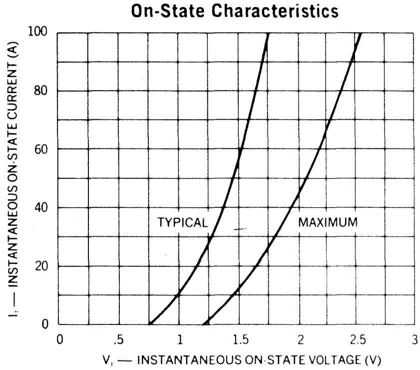
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

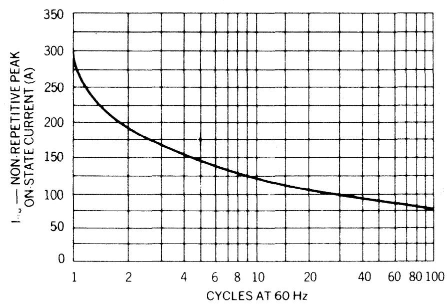
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	4.0	mA	V_{DRM} = Rating T_C = 100°C
Gate Trigger Current	I_{GT}	—	—	80 120	mA	V_D = 12V Quadrant 1, 3 (+ +, — —) V_D = 12V Quadrant 2, 4 (+ —, — +)
Gate Trigger Voltage	V_{GT}	—	—	3.0	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.0	V	I_{TM} = 42A Peak
Holding Current	I_H	—	—	60	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	40 25 20 10	75 50 40 25	—	V/μS	L1BO4302F L1BO4304F V_{DRM} = Rating, T_C = 100°C L1BO4306F L1BO4308F
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	3	15	—	V/μS	I_T = Rating, V_{DRM} = Rating, T_C = 65°C
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	.8	°C/W	Steady State

* Junction-to-Case

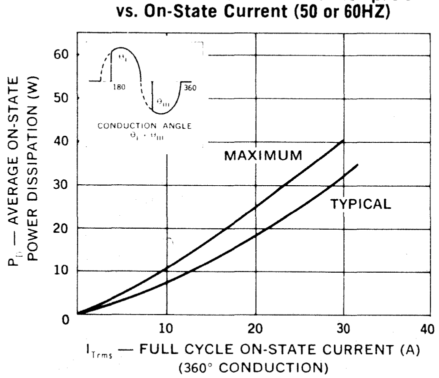
On-State Characteristics



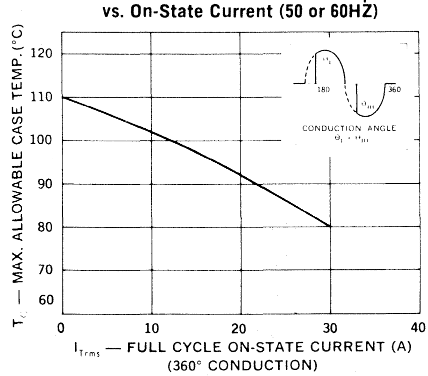
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

TRIACs

40 Amp RMS, 800V, ChipStrate®

L1BO5402F
L1BO5404F
L1BO5406F
L1BO5408F

FEATURES

- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

DESCRIPTION

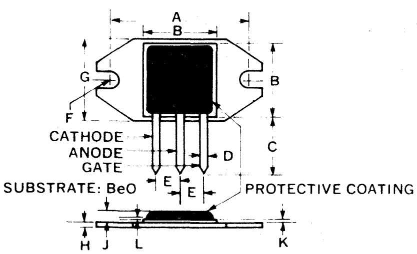
Unitrode ChipStrate power Triacs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L1BO5402F	L1BO5404F	L1BO5406F	L1BO5408F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
On-State Current $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 360°)		40A		
Peak One Cycle Surge (Non-Rep.) On-State Current, $I_{T(RMS)}$		400A		
Peak Gate Power, P_{GM}		16W		
Average Gate Power $P_{G(AV)}$		.75W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 250mA$, $t_r = .1\mu s$)		200 A/μs		
Storage Temperature Range		−40°C to +150°C		
Operating Temperature Range		−40°C to +110°C		

MECHANICAL SPECIFICATIONS

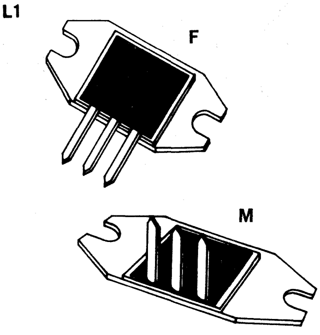
L1BO5402F L1BO5404F L1BO5406F L1BO5408F



L1 with Flange

	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.650	16.51
C	.500 NOM.	12.70 NOM.
D	.060	1.53
E	.200	5.08
F	.078 R. TYP.	.20 R. TYP.
G	.690 – .710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51

L1



PART NO. SUFFIX: When ordering, specify correct part number suffix.

F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

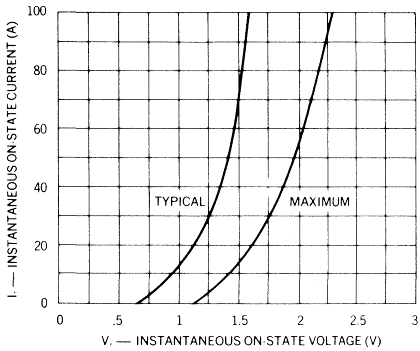
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

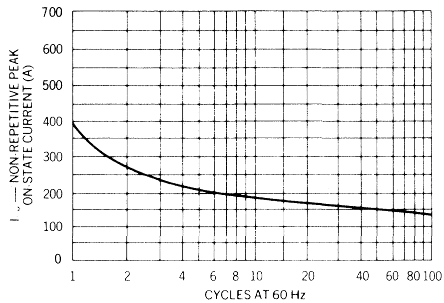
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	4.0	mA	V_{DRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	— —	— —	80 120	mA mA	V_D = 12V Quadrants 1, 3 (+ +, − −) V_D = 12V Quadrants 2, 4 (+ −, − +)
Gate Trigger Voltage	V_{GT}	—	—	3.0	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.0	V	I_{TM} = 57A Peak
Holding Current	I_H	—	—	90	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	40 25 20 10	150 100 75 50	— — — —	V/μS	L1BO5402F L1BO5404F L1BO5406F L1BO5408F V_{DRM} = Rating, T_C = 100°C
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	4	10	—	V/μS	I_T = Rating, V_{DRM} = Rating, T_C = 65°C
Steady State Thermal Resistance*	$R\theta_{JC}$	—	—	.7	°C/W	Steady State

* Junction-to-Case

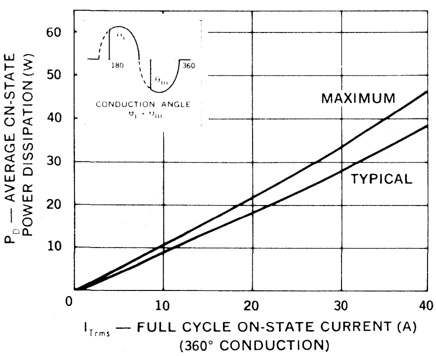
On-State Characteristics



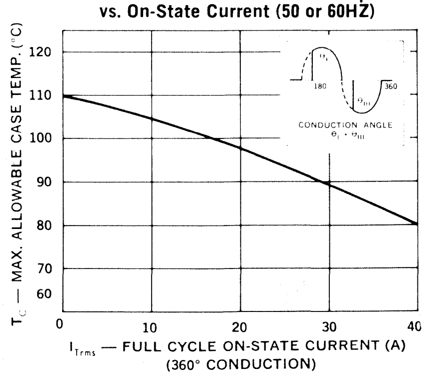
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

SCRs
40 Amp RMS, 800V, ChipStrate®

L1RO4402F
L1RO4404F
L1RO4406F
L1RO4408F

FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

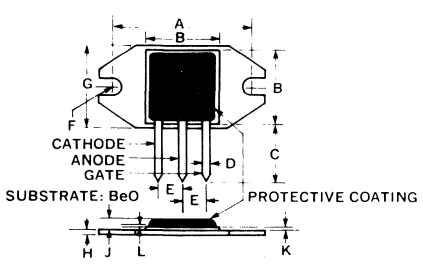
DESCRIPTION
Unitrode ChipStrate power SCRs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L1RO4402F	L1RO4404F	L1RO4406F	L1RO4408F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 180°)		40A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}		400A		
Peak Gate Power, P_{GM}		40W		
Average Gate Power, $P_{G(AV)}$		.5W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 200mA$, $t_r = .5\mu s$)		200 A/μs		
Fusing Current, $I^2{}_t$ (for SCR Protection) $T_j = -40°C$ to 110°C, 1 to 8.3msec		400 A^2s		
Storage Temperature Range		−40°C to +150°C		
Operating Temperature Range		−40°C to +110°C		

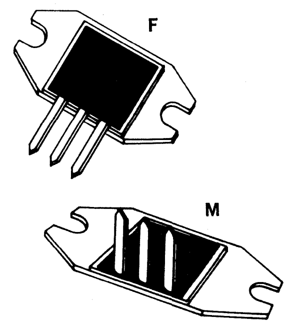
MECHANICAL SPECIFICATIONS

L1RO4402F L1RO4404F L1RO4406F L1RO4408F



L1 with Flange	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.650	16.51
C	.500 NOM.	12.70 NOM.
D	.060	1.53
E	.200	5.08
F	.078 R. TYP.	.20 R. TYP.
G	.690 – .710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51

L1



PART NO. SUFFIX: When ordering, specify correct part number suffix.

F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

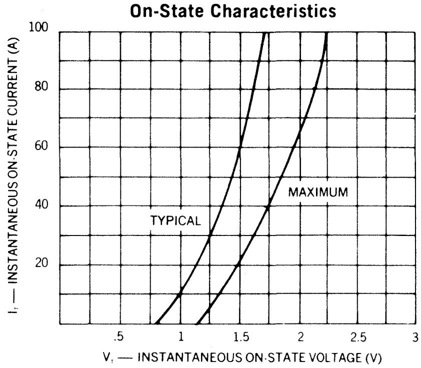
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

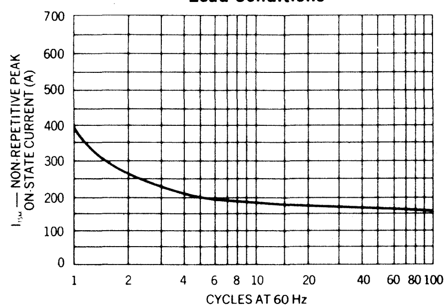
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	3.0	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}	—	—	3.0	mA	V_{RRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	—	—	40	mA	V_D = 12V
Gate Trigger Voltage	V_{GT}	—	—	2.5	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.1	V	I_{TM} = 75A Peak
Holding Current	I_H	—	—	70	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	150	250	—	V/μS	V_{DRM} = Rating, T_C = 100°C
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	.8	°C/W	Steady State

* Junction-to-Case

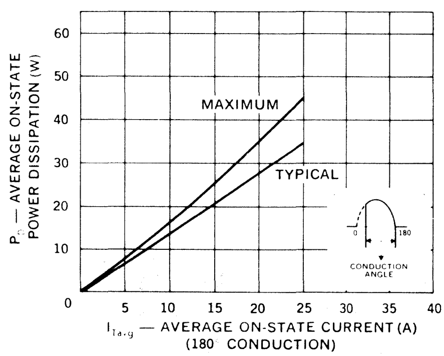
On-State Characteristics



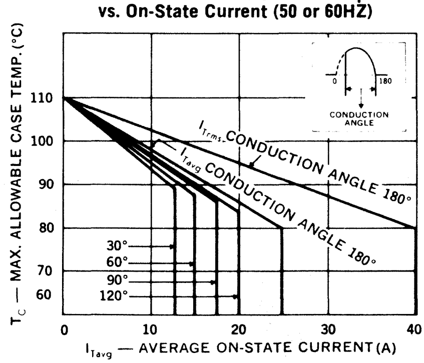
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Copper Tab
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

SCRs
55 Amp RMS, 800V, ChipStrate®

L1RO5552F
L1RO5554F
L1RO5556F
L1RO5558F

FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

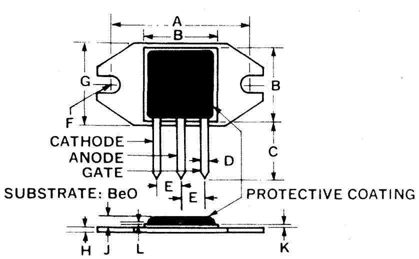
DESCRIPTION
Unitrode ChipStrate power SCRs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L1RO5552F	L1RO5554F	L1RO5556F	L1RO5558F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 180°)	55A			
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	550A			
Peak Gate Power, P_{GM}	40W			
Average Gate Power, $P_{G(AV)}$	.5W			
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 250mA$, $t_r = .5\mu s$)	250 A/μs			
Fusing Current, I^2_t (for SCR Protection) $T_j = -40°C$ to 110°C, 1 to 8.3msec	500 A^2s			
Storage Temperature Range	−40°C to +150°C			
Operating Temperature Range	−40°C to +110°C			

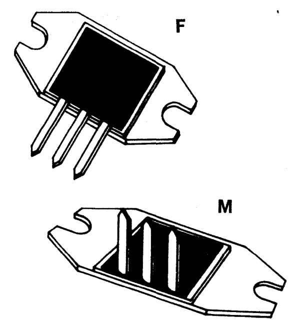
MECHANICAL SPECIFICATIONS

L1RO5552F L1RO5554F L1RO5556F L1RO5558F



L1 with Flange	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.650	16.51
C	.500 NOM.	12.70 NOM.
D	.060	1.53
E	.200	5.08
F	.078 R. TYP.	.20 R. TYP.
G	.690 – .710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51

L1



PART NO. SUFFIX: When ordering, specify correct part number suffix.
F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

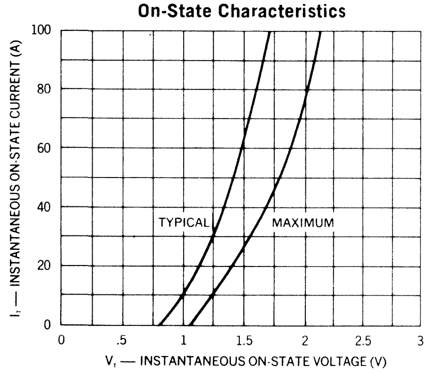
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

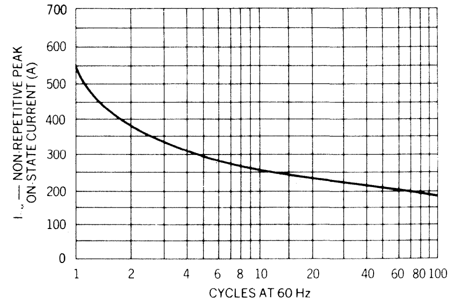
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	4.0	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}	—	—	4.0	mA	V_{RRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	—	—	100	mA	V_D = 12V
Gate Trigger Voltage	V_{GT}	—	—	2.5	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.1	V	I_{TM} = 100A Peak
Holding Current	I_H	—	—	100	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	200	300	—	V/μS	V_{DRM} = Rating, T_C = 100°C
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	.7	°C/W	Steady State

* Junction-to-Case

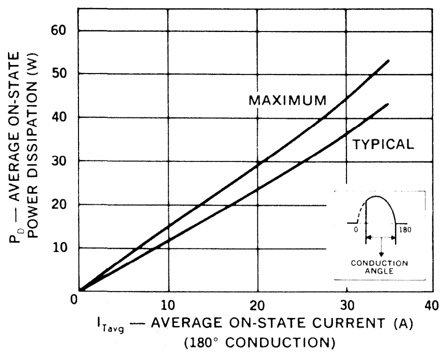
On-State Characteristics



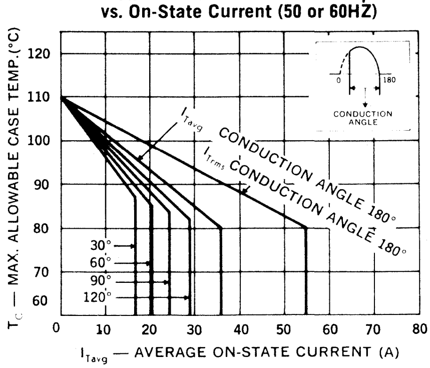
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

TRIACs

20 Amp RMS, 800V, ChipStrate®

L2BO6202F
L2BO6204F
L2BO6206F
L2BO6208F

FEATURES

- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

DESCRIPTION

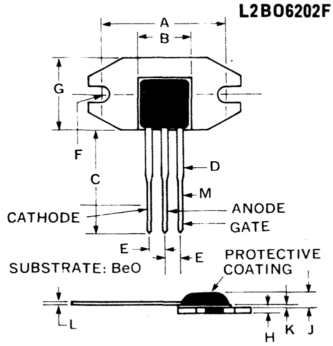
Unitrode ChipStrate power Triacs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

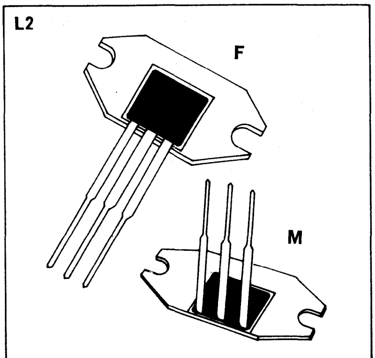
	L2BO6202F	L2BO6204F	L2BO6206F	L2BO6208F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
On-State Current $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 360°)	20A			
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	200A			
Peak Gate Power, P_{GM}	16W			
Average Gate Power, $P_{G(AV)}$	.5W			
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 175mA$, $t_r = .1\mu s$)	125 A/μs			
Storage Temperature Range	−40°C to +150°C			
Operating Temperature Range	−40°C to +110°C			

MECHANICAL SPECIFICATIONS

L2BO6202F L2BO6204F L2BO6206F L2BO6208F



L2 with Flange		
	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.500	12.70
C	1.0 NOM.	25.4 NOM.
D	.060	1.53
E	.150	3.81
F	.078 R. TYP.	.20 R. TYP.
G	.690 – 710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51
M	.040	1.02



PART NO. SUFFIX: When ordering, specify correct part number suffix.

F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

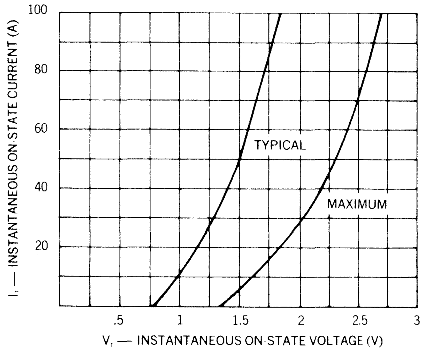
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

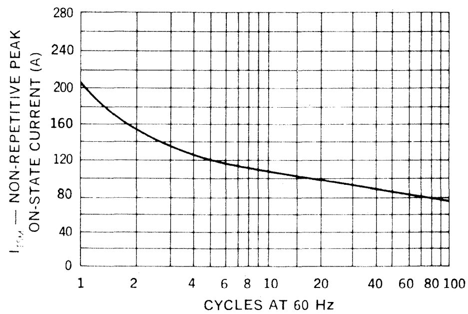
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, $T_C = 100°C$
Gate Trigger Current	I_{GT}	— —	— —	50 80	mA	V_D = 12V Quadrants 1, 3 (+ +, − −) V_D = 12V Quadrants 2, 4 (+ −, − +)
Gate Trigger Voltage	V_{GT}	—	—	2.5	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	1.9	V	I_{TM} = 28A Peak
Holding Current	I_H	—	—	50	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	30 20 10 10	75 50 30 25	— — — —	V/μS	L2BO6202F L2BO6204F L2BO6206F L2BO6208F V_{DRM} = Rating, $T_C = 100°C$
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	3	10	—	V/μS	I_T = Rating, V_{DRM} = Rating, $T_C = 65°C$
Steady State Thermal Resistance*	$R\theta_{JC}$	—	—	1.1	°C/W	Steady State

* Junction-to-Case

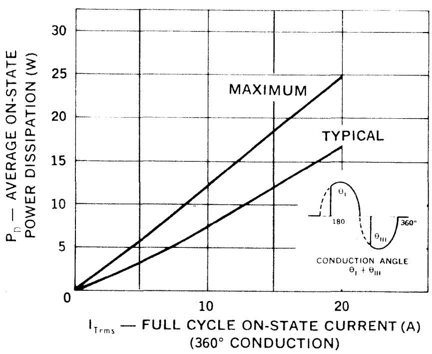
On-State Characteristics



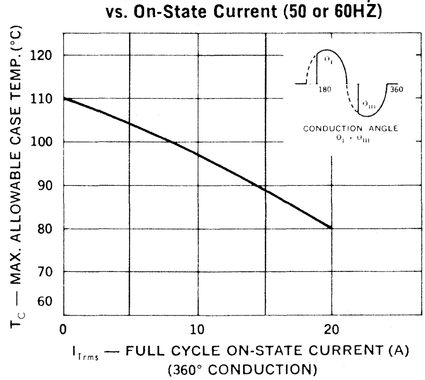
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

SCRs

10 Amp. RMS 800V ChipStrate®
Fast Turn-Off Types
For Inverter and Pulse Applications

L2R06102FG
L2R06104FG
L2R06106FG
L2R06108FG

FEATURES:
- Fast Turn-Off Time
- Shorted Emitter Construction
- High-Current Pulse Capability
- High di/dt and dv/dt Rating
- Center Gate Construction
- Isolated Case
- Economical Design

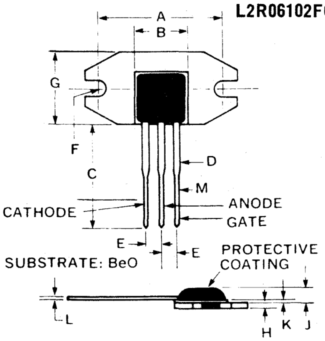
DESCRIPTION:
This series of SCR's is specifically designed for use in inverter and high current pulse applications and exhibits excellent turn-off capability even at much higher currents than their rated values. These devices are made with the most advanced hard glass passivated chips mounted on Unitrode's very economical ChipStrate package.

ABSOLUTE MAXIMUM RATINGS

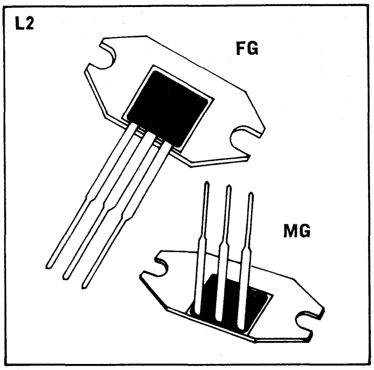
	L2R06102FG	L2R06104FG	L2R06106FG	L2R06108FG
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 180°)	10A			
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM} (60 Hz Sinusoidal)	120A			
Peak Gate Power, P_{GM} (for 10μs Max.)	20W			
Average Gate Power $P_{G(AV)}$	.5W			
Storage Temperature Range	−40°C to +150°C			
Operating Temperature Range	−40°C to +110°C			
Rate of Change of On-State Current di/dt @ V_{DRM}	150 A/μs			
Fusing Current I^2t (T_J = −40 to 100°C t = 1 to 8.3ms)	85 A^2 sec			

MECHANICAL SPECIFICATIONS

L2R06102FG L2R06104FG L2R06106FG L2R06108FG



L2 with Flange		
	INS.	mm
A	1.176 - 1.196	29.87 - 30.38
B	.500	12.70
C	1.0 NOM.	25.4 NOM.
D	.060	1.53
E	.150	3.81
F	.078 R. TYP.	.20 R. TYP.
G	.690 - 710	17.52 - 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51
M	.040	1.02



PART NO. SUFFIX: When ordering, specify correct part number suffix.
FG — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
MG — FLANGE MOUNTED, PREBENT LEADS
SG — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
BG — SOLDERABLE BACK, PREBENT LEADS (not shown)

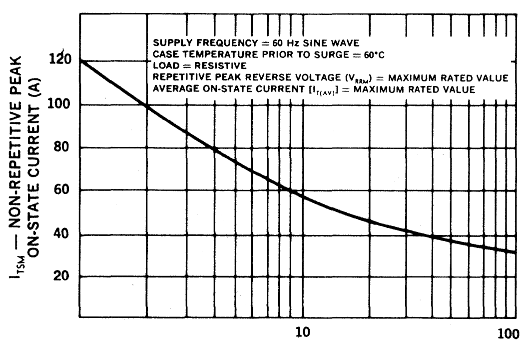
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

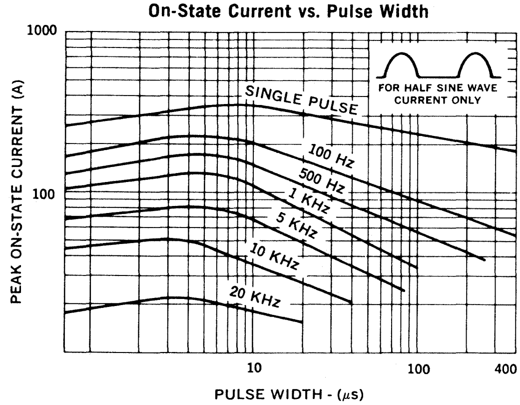
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}		2	4	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}		2	4	mA	V_{RRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}		30	70	mA	V_D = 12V, R_L = 30Ω
Gate Trigger Voltage	V_{GT}		1.2	3	V	V_D = 12V, R_L = 30Ω
Peak On-State Voltage	V_{TM}			10	V	I_{TM} = 100A (Peak)
Holding Current	I_H		130	175	mA	V_D = 12V, Gate Open
Critical Rate of Rise of Off-State Voltage	dv/dt	400			V/μsec	$V_D = V_{DRM}$, T_C = 80°C
Gate Controlled Turn-On Time, $t_d + t_r$	t_{on}		1.0		μsec	I_T = 2A, I_{GT} = 200mA $V_D = V_{DRM}$
Circuit Commutated Turn-Off Time	t_q		6	8	μsec	Note 1
Thermal Resistance Junction-to-Case	$R_{\theta JC}$			1.3	°C/W	

Note 1 $V_D = V_{DRM}$, I_T = 100A, PW = 50μsec
V_{RX} = −15V min, V_{GT} = OV (at t_{off})
dv/dt = 100 v/μsec, −5A/μsec
I_{GT} = 100mA, T_C = 80°C

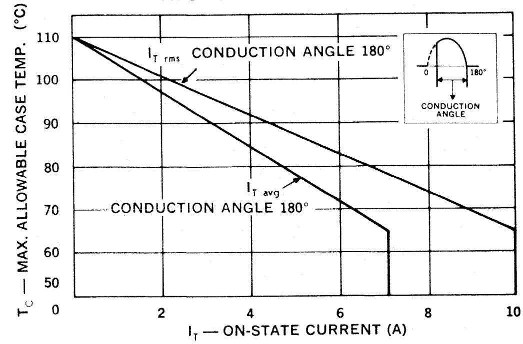
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



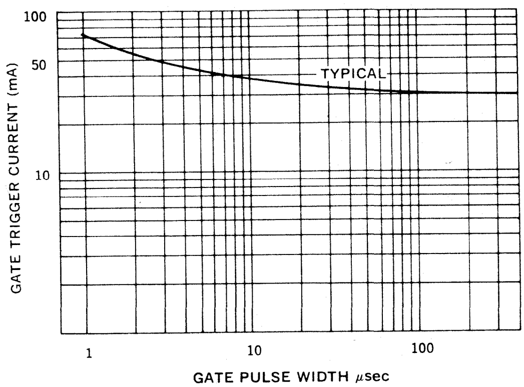
Maximum Allowable Peak On-State Current vs. Pulse Width



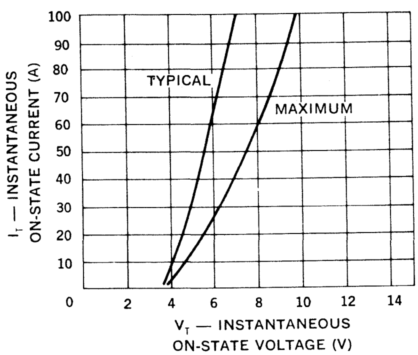
Maximum Allowable Case Temp. vs. On-State Current (50 or 60Hz)



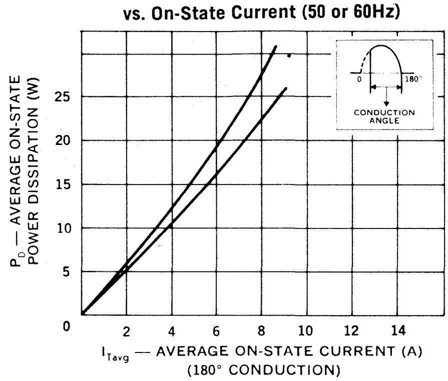
Gate Trigger Current vs. Gate Pulse Width $t_r = 20$ nsec



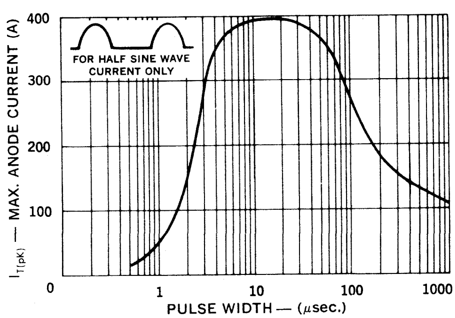
On-State Characteristics



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60Hz)



Maximum Peak Current vs. Pulse Width



SCRs
25 Amp RMS, 800V, ChipStrate®

L2RO6252F
L2RO6254F
L2RO6256F
L2RO6258F

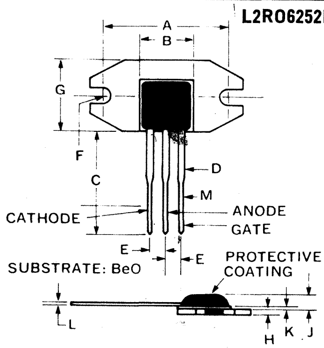
FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

DESCRIPTION
Unitrode ChipStrate power SCRs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

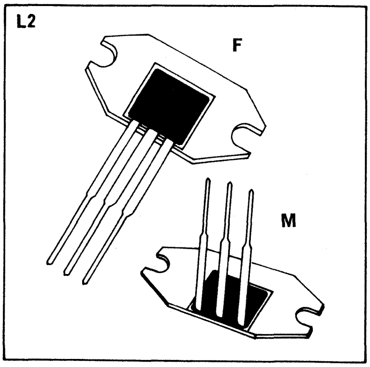
	L2RO6252F	L2RO6254F	L2RO6256F	L2RO6258F
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 80°C$ and conduction angle of 180°)	25A			
Peak One Cycle Surge (Non-Rep.) On--State Current, I_{TSM}	250A			
Peak Gate Power, P_{GM}	20W			
Average Gate Power $P_{G(AV)}$	.5W			
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 150mA$, $t_r = .5\mu s$)	150 A/μs			
Fusing Current, I^2t (for SCR Protection) $T_j = -40°C$ to 110°C, 1 to 8.3msec	250 A^2s			
Storage Temperature Range	−40°C to +150°C			
Operating Temperature Range	−40°C to +110°C			

MECHANICAL SPECIFICATIONS



L2RO6252F L2RO6254F L2RO6256F L2RO6258F

L2 with Flange		
	INS.	mm
A	1.176 - 1.196	29.87 - 30.38
B	.500	12.70
C	1.0 NOM.	25.4 NOM.
D	.060	1.53
E	.150	3.81
F	.078 R. TYP.	.20 R. TYP.
G	.690 - 710	17.52 - 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51
M	.040	1.02



PART NO. SUFFIX: When ordering, specify correct part number suffix.
F — (standard package) — FLANGE MOUNTED, STRAIGHT LEADS
M — FLANGE MOUNTED, PREBENT LEADS
S — SOLDERABLE BACK, STRAIGHT LEADS (not shown)
B — SOLDERABLE BACK, PREBENT LEADS (not shown)

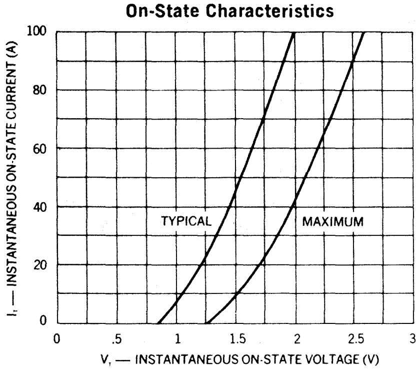
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

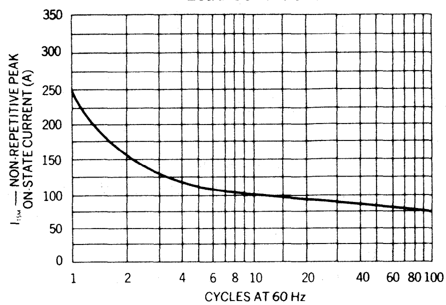
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}	—	—	2.0	mA	V_{RRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	—	—	25	mA	V_D = 12V
Gate Trigger Voltage	V_{GT}	—	—	2.0	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.1	V	I_{TM} = 50A Peak
Holding Current	I_H	—	—	50	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	100	200	—	V/μS	V_{DRM} = Rating, T_C = 100°C
Steady State Thermal Resistance*	$R\theta_{JC}$	—	—	1.1	°C/W	Steady State

* Junction-to-Case

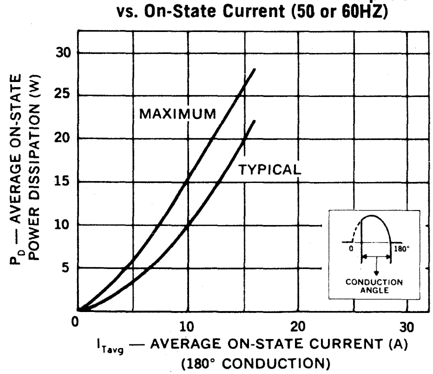
On-State Characteristics



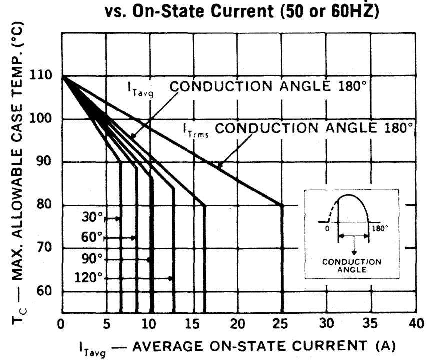
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

TRIACs
10 Amp RMS, 800V, ChipStrate®

L7BO8102S
L7BO8104S
L7BO8106S
L7BO8108S

FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

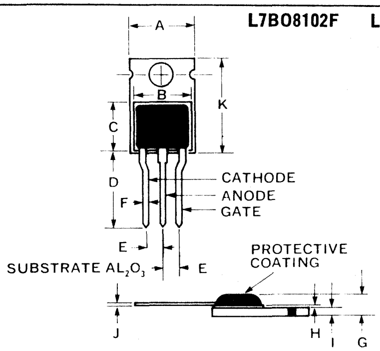
DESCRIPTION
Unitrode ChipStrate power Triacs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L7BO8102S	L7BO8104S	L7BO8106S	L7BO8108S
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
On-State Current $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 360°)		10A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}		100A		
Peak Gate Power, P_{GM}		16W		
Average Gate Power $P_{G(AV)}$		.5W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 150mA$, $t_r = .1\mu s$)		100 A/μs		
Storage Temperature Range		−40°C to +150°C		
Operating Temperature Range		−40°C to +110°C		

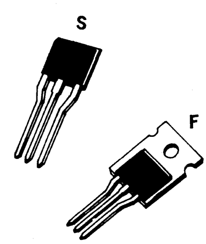
MECHANICAL SPECIFICATIONS

L7BO8102F L7BO8104F L7BO8106F L7BO8108F



L7 with Flange		
	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

L7



PART NO. SUFFIX: When ordering, specify correct part number suffix.

S (standard package) — SOLDERABLE BACK, STRAIGHT LEADS
F — FLANGE MOUNTED, STRAIGHT LEADS

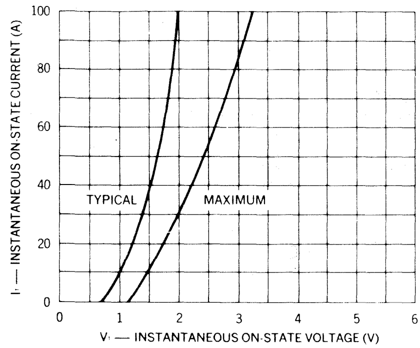
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

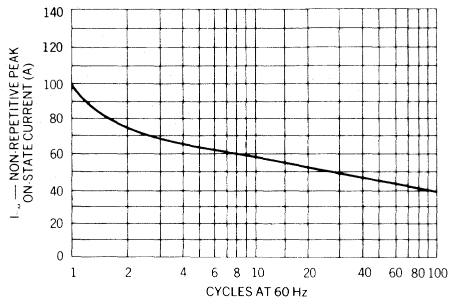
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	— —	— —	30 50	mA mA	V_D = 12V Quadrants 1 & 2 (+ +, — —) V_D = 12V Quadrants 3 & 4 (— +, + —)
Gate Trigger Voltage	V_{GT}	—	—	2.0	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	1.6	V	I_{TM} = 14A Peak
Holding Current	I_H	—	—	30	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	30 20 10 10	75 50 30 25	— — — —	V/μS	L7BO8102S L7BO8104S L7BO8106S L7BO8108S V_{DRM} = Rating, T_C = 100°C
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	3	10	—	V/μS	I_T = Rating, V_{DRM} = Rating, T_C = 65°C
Steady State Thermal Resistance*	$R\theta_{JC}$	—	—	3.0	°C/W	Steady State

*Junction-to-Case

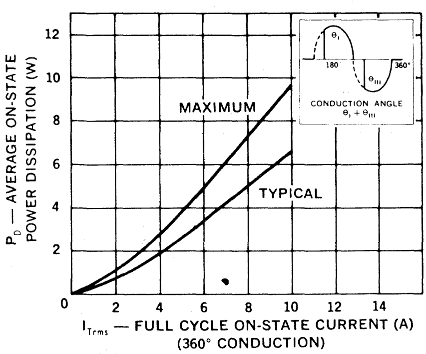
On-State Characteristics



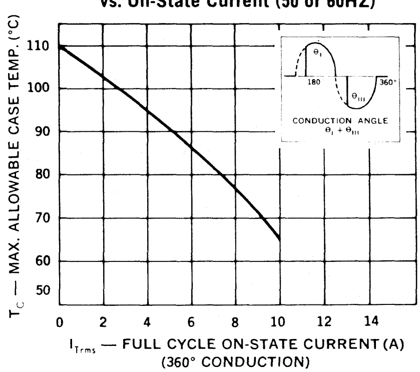
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

TRIACs

3 Amp RMS, 800V, ChipStrate®

L7BO9032S
L7BO9034S
L7BO9036S
L7BO9038S

FEATURES

- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

DESCRIPTION

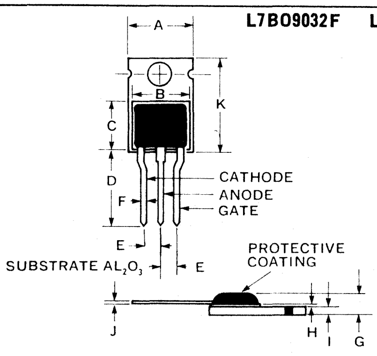
Unitrode ChipStrate power Triacs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L7BO9032S	L7BO9034S	L7BO9036S	L7BO9038S
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
On-State Current $I_{T(RMS)}$ (at T_C = 65°C and conduction angle of 360°)	3A			
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}	30A			
Peak Gate Power, P_{GM}	5W			
Average Gate Power, $P_{G(AV)}$	.3W			
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, I_{GT} = 25mA, t_r = .1μs)	20 A/μs			
Storage Temperature Range	−40°C to +150°C			
Operating Temperature Range	−40°C to +110°C			

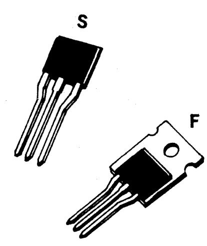
MECHANICAL SPECIFICATIONS

L7BO9032F L7BO9034F L7BO9036F L7BO9038F



L7 with Flange	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

L7



PART NO. SUFFIX: When ordering, specify correct part number suffix.

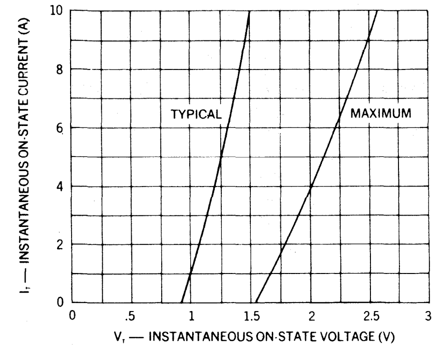
S (standard package) — SOLDERABLE BACK, STRAIGHT LEADS
F — FLANGE MOUNTED, STRAIGHT LEADS

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

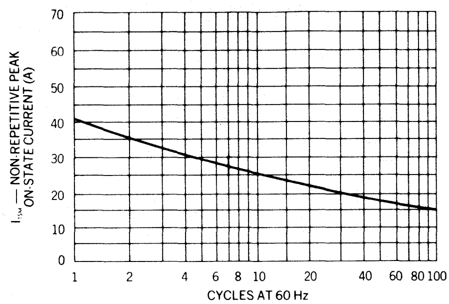
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}	— —	— —	25 25	mA mA	V_D = 12V Quadrants 1, 3 (+ +, — —) V_D = 12V Quadrants 2, 4 (+ —, — +)
Gate Trigger Voltage	V_{GT}	—	—	2.0	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.1	V	I_{TM} = 4.0A Peak
Holding Current	I_H	—	—	25	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	15 10 5 3	60 40 20 10	— — — —	V/μS	L7BO9032S L7BO9034S L7BO9036S L7BO9038S — V_{DRM} = Rating, T_C = 100°C
Critical Rate of Rise — Commutated Off-State Voltage	$dv/dt_{(c)}$	3	6	—	V/μS	I_T = Rating, V_{DRM} = Rating, T_C = 65°C
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	8.0	°C/W	Steady State

* Junction-to-Case

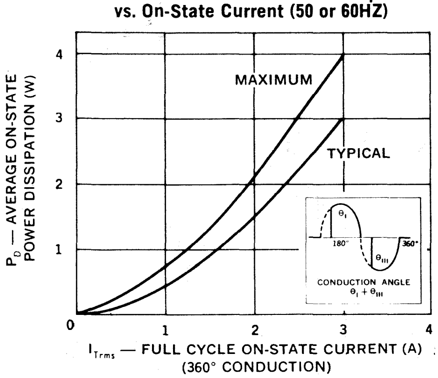
On-State Characteristics



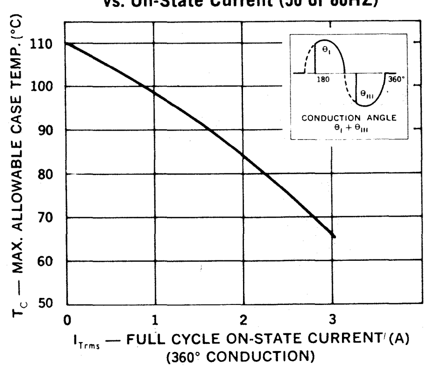
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Solder
2. Screw Mount Using Copper Tab
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

SCRs

4 Amp RMS, 800V, ChipStrate®

Sensitive Gate

L7RA9042S
L7RA9044S
L7RA9046S
L7RA9048S

FEATURES

- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

DESCRIPTION

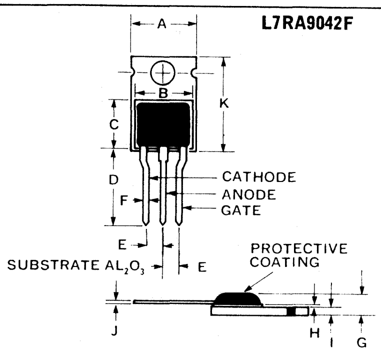
Unitrode ChipStrate power SCRs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device. These devices have microampere gate sensitivity and, therefore, are ideally suited for direct drive from low level IC sources.

ABSOLUTE MAXIMUM RATINGS

	L7RA9042S	L7RA9044S	L7RA9046S	L7RA9048S
Repetitive Peak Off-State Voltage V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 180°)		4A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}		40A		
Peak Gate Power, P_{GM}		5W		
Average Gate Power, $P_{G(AV)}$		.4W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 1mA$, $t_r = .5\mu s$)		80 A/μs		
Fusing Current, $I^2{}_t$ (for SCR Protection) $T_j = -40°C$ to 110°C, 1 to 8.3msec		25 A^2s		
Storage Temperature Range		—40°C to +150°C		
Operating Temperature Range		40°C to +110°C		

MECHANICAL SPECIFICATIONS

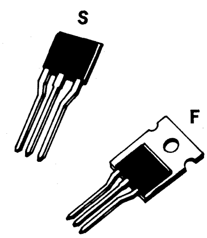
L7RA9042F L7RA9044F L7RA9046F L7RA9048F



L7 with Flange

	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

L7



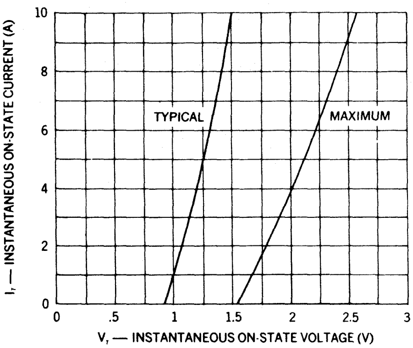
PART NO. SUFFIX: When ordering, specify correct part number suffix.
S (standard package) — SOLDERABLE BACK, STRAIGHT LEADS
F — FLANGE MOUNTED, STRAIGHT LEADS

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

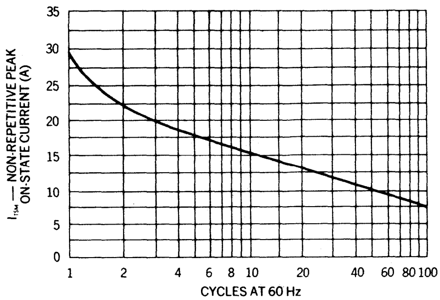
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	1.0	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}	—	—	1.0	mA	V_{RRM} = Rating T_C = 100°C
Gate Trigger Current	I_{GT}	—	—	200	μA	V_D = 12V
Gate Trigger Voltage	V_{GT}	—	—	1.5	V	V_D = 12V
Peak On-State Voltage	V_{TM}	—	—	2.0	V	I_{TM} = 4.0A Peak
Holding Current	I_H	—	—	5	mA	V_D = 12V
Critical Rate of Rise — Off-State Voltage	dv/dt	5	8	—	V/μS	V_{DRM} = Rating, T_C = 100°C R_{GK} = 1K
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	8.0	°C/W	Steady State

* Junction-to-Case

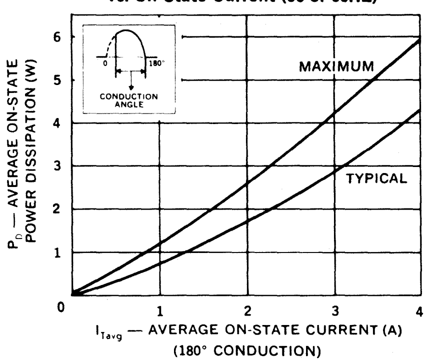
On-State Characteristics



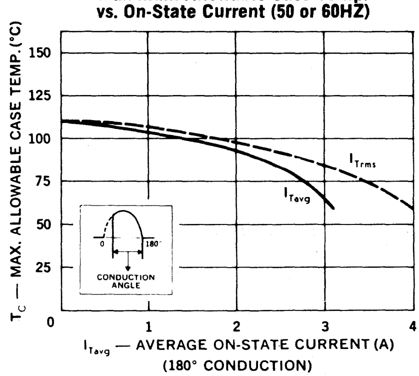
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Solder
2. Screw Mount Using Copper Tab
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

SCRs

5 Amp. RMS 800V ChipStrate®
Fast Turn-Off Types
For Inverter and Pulse Applications

L7R08052SG
L7R08054SG
L7R08056SG
L7R08058SG

FEATURES:
- Fast Turn-Off Time
- Shorted Emitter Construction
- High-Current Pulse Capability
- High di/dt and dv/dt Rating
- Center Gate Construction
- Isolated Case
- Economical Design

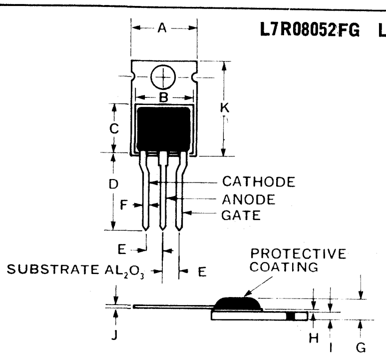
DESCRIPTION:
This series of SCR's is specifically designed for use in inverter and high current pulse applications and exhibits excellent turn-off capability even at much higher currents than their rated values. These devices are made with the most advanced hard glass passivated chips mounted on Unitrode's economical ChipStrate package.

ABSOLUTE MAXIMUM RATINGS

	L7R08052SG	L7R08054SG	L7R08056SG	L7R08058SG
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 180°)	5A			
Peak One Cycle (Non-Rep.) On-State Current, I_{TSM} 60 Hz (Sinusoidal)	80A			
Peak Gate Power, P_{GM} (for 10μs Max)	5W			
Average Gate Power, $P_{G(AV)}$	.5W			
Storage Temperature Range	—40°C to +150°C			
Operating Temperature Range	—40°C to +110°C			
Rate of Change of On-State Current di/dt @ V_{DRM}	200 A/μs			
Fusing Current I^2t(T_J = —40 to 100°C t = 1 to 8.3ms)	60 A^2sec			

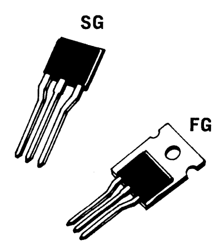
MECHANICAL SPECIFICATIONS

L7R08052FG L7R08054FG L7R08056FG L7R08058FG



L7 with Flange		
	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

L7



PART NO. SUFFIX: When ordering, specify correct part number suffix.
SG (standard package) — SOLDERABLE BACK, STRAIGHT LEADS
FG — FLANGE MOUNTED, STRAIGHT LEADS

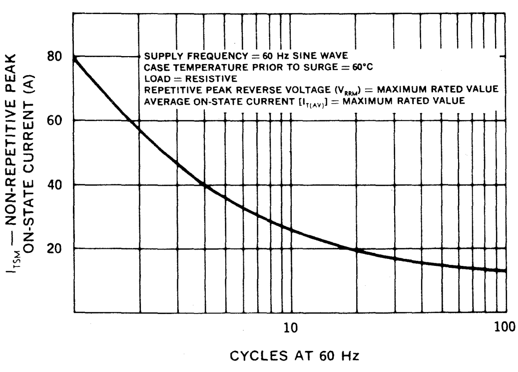
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

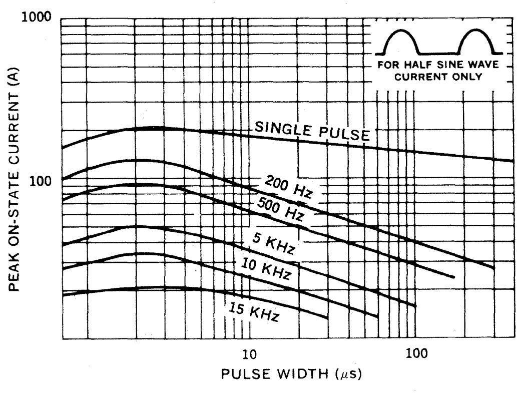
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-state Current	I_{DRM}		0.4	3	mA	V_{DRM} = Rating, T_C = 100°C
Reverse Current	I_{RRM}		0.4	2	mA	V_{RRM} = Rating, T_C = 100°C
Gate Trigger Current	I_{GT}		20	40	mA	V_D = 12V, R_L = 30Ω
Gate Trigger Voltage	V_{GT}		1.5	3.0	V	V_D = 12V, R_L = 30Ω
Peak On-state Voltage	V_{TM}		2.0	3.0	V	I_{TM} = 30A (Peak)
Holding Current	I_H		20	50	mA	V_D = 12V, Gate open
Critical rate of rise of Off-state Voltage	dv/dt	200	400		V/μsec	$V_D = V_{DRM}$, T_C = 80°C
Gate controlled turn-on time (td + tr)	t_{on}		0.7		μsec	I_T = 2A, I_{GT} = 200mA $V_D = V_{DRM}$
Circuit commutated turn-off time	t_q		8	10	μsec	Note 1
Thermal Resistance Junction-to-case	$R_{\theta JC}$			7	°C/W	

Note 1 $V_D = V_{DRM}$, I_T = 20A, PW = 50μsec
V_{RX} = −15V Min, V_{GT} = OV (at t_{off})
dv/dt = 100V/μsec, −di/dt = −10A/μsec
I_{GT} = 100mA, T_C = 80°C

Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Allowable Peak On-State Current vs. Pulse Width



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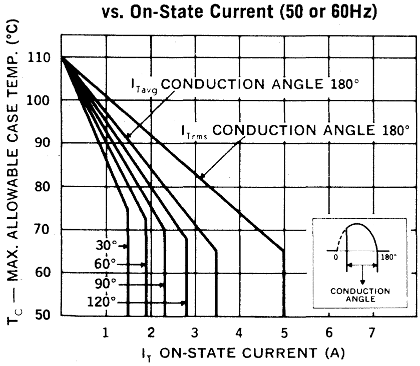
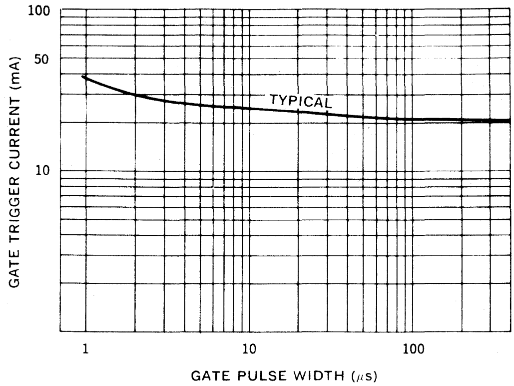
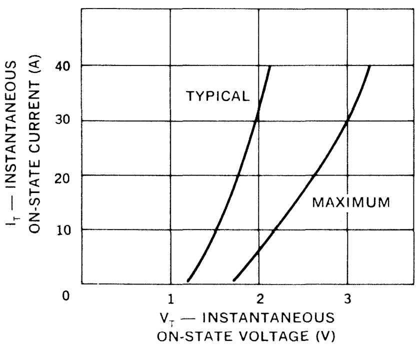
Maximum Allowable Case Temp. vs. On-State Current (50 or 60Hz)



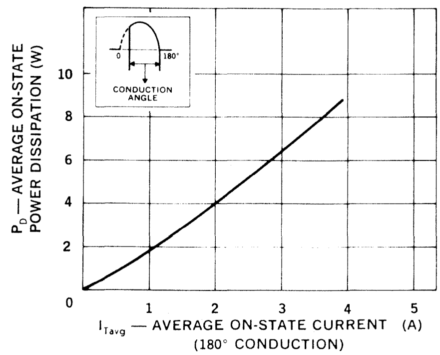
Gate Trigger Current vs. Gate Pulse Width tr = 20 nsec



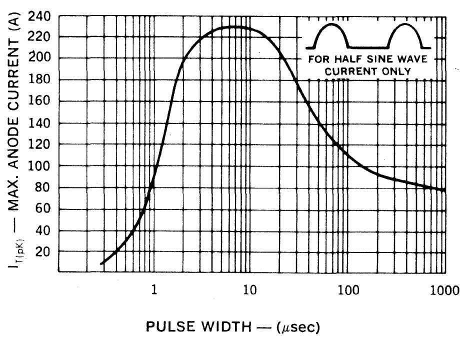
On-State Characteristics



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60Hz)



Maximum Peak Current vs. Pulse Width



SCRs
15 Amp RMS, 800V, ChipStrate®

L7RO8152S
L7RO8154S
L7RO8156S
L7RO8158S

FEATURES
- Voltage Ratings: to 800V
- Hard-Glass Passivated Junction
- Miniature Size
- Isolated Case
- Economical Design

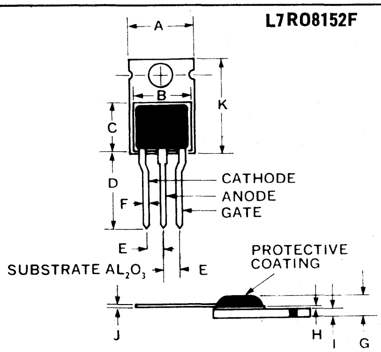
DESCRIPTION
Unitrode ChipStrate power SCRs combine the most advanced hard-glass passivated chips with a metallized ceramic substrate. The resultant ChipStrate provides the economy of an unpackaged chip with the reliability and handling ease of a discrete device.

ABSOLUTE MAXIMUM RATINGS

	L7RO8152S	L7RO8154S	L7RO8156S	L7RO8158S
Repetitive Peak Off-State Voltage, V_{DRM}	200V	400V	600V	800V
Repetitive Peak Reverse Voltage, V_{RRM}	200V	400V	600V	800V
On-State Current, $I_{T(RMS)}$ (at $T_C = 65°C$ and conduction angle of 180°)		15A		
Peak One Cycle Surge (Non-Rep.) On-State Current, I_{TSM}		150A		
Peak Gate Power, P_{GM}		10W		
Average Gate Power, $P_{G(AV)}$		.5W		
Rate of On-State Current, di/dt (at $V_{DM} = V_{DRM}$, $I_{GT} = 100mA$, $t_r = .5\mu s$)		125 A/μs		
Fusing Current, $I^2{}_t$ (for SCR Protection) $T_j = -40°C$ to 110°C, 1 to 8.3msec		150 A^2s		
Storage Temperature Range		−40°C to +150°C		
Operating Temperature Range		−40°C to +110°C		

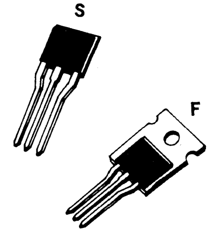
MECHANICAL SPECIFICATIONS

L7RO8152F L7RO8154F L7RO8156F L7RO8158F



L7 with Flange		
	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

L7



PART NO. SUFFIX: When ordering, specify correct part number suffix.
S (standard package) — SOLDERABLE BACK, STRAIGHT LEADS
F — FLANGE MOUNTED, STRAIGHT LEADS

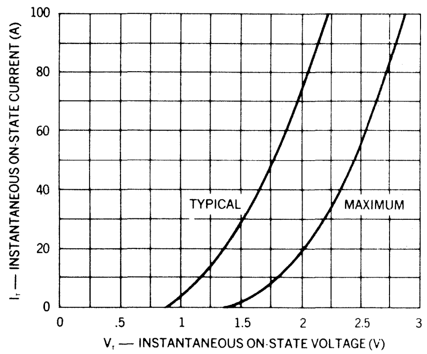
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

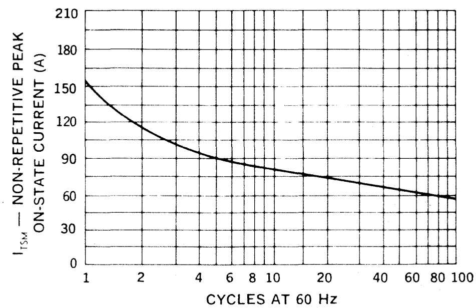
Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	—	2.0	mA	V_{DRM} = Rating, $T_C = 100°C$
Reverse Current	I_{RRM}	—	—	2.0	mA	V_{RRM} = Rating $T_C = 100°C$
Gate Trigger Current	I_{GT}	—	—	15	mA	$V_D = 12V$
Gate Trigger Voltage	V_{GT}	—	—	1.5	V	$V_D = 12V$
Peak On-State Voltage	V_{TM}	—	—	2.1	V	$I_{TM} = 25A$ Peak
Holding Current	I_H	—	—	25	mA	$V_D = 12V$
Critical Rate of Rise — Off-State Voltage	dv/dt	100	200	—	V/μS	V_{DRM} = Rating, $T_C = 100°C$
Steady State Thermal Resistance*	$R\Theta_{JC}$	—	—	3.0	°C/W	Steady State

* Junction-to-Case

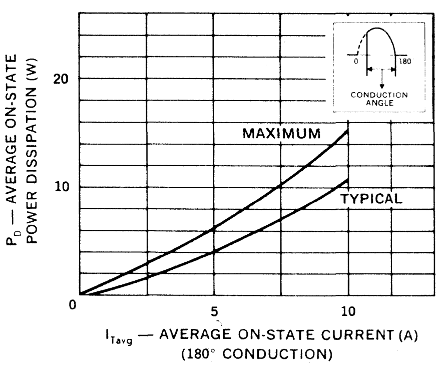
On-State Characteristics



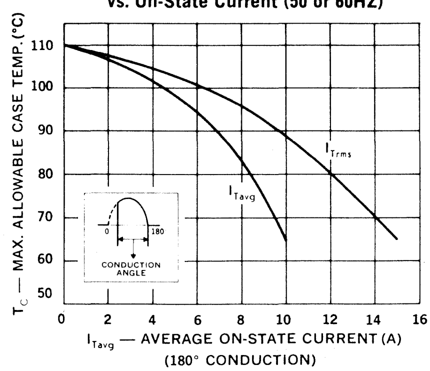
Maximum Allowable Non-Repetitive Peak On-State Current Following Rated Load Conditions



Maximum Conduction Power Dissipation vs. On-State Current (50 or 60HZ)



Maximum Allowable Case Temp. vs. On-State Current (50 or 60HZ)



RECOMMENDED MOUNTING METHODS

1. Screw Mount Using Standard Flange
2. Solder
3. Thermally Conductive Epoxy
4. Two-Sided Adhesive Electrical Tape
5. P.C. Board Mount (For Low Duty Cycle Applications)

PUTs

P13T1-P13T2

Planar, TO-92, Plastic

FEATURES

- TO-92 Plastic Package
- Maximum Peak Current: 0.15 μA
- Minimum Valley Current: 70 μA
- Peak Forward Current: 5A
- Programmable Eta, R_{BB}, I_p and I_V
- Passivated Planar Construction for Maximum Reliability and Parameter Uniformity

DESCRIPTION

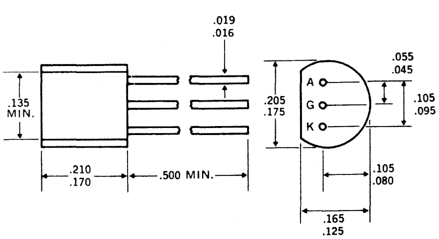
Functionally equivalent to standard unijunction transistors, Unitrode's Programmable Unijunction Transistors offer the distinct advantage of versatile programming. External resistors can be added to meet the designer's needs in programming Eta, R_{BB}, I_P and I_V functions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators and sensing circuits. For additional information see Unitrode Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

Anode-to-Cathode Voltage, V_{AK}	±40V
Gate-to-Cathode Forward Voltage, V_{GK}	40V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V
Gate-to-Cathode Reverse Voltage, V_{GKR}	−5V
Peak Recurrent Forward Current	
10μs, 1% Duty Cycle	5A
100μs, 1% Duty Cycle	1A
Power Dissipation	
25°C Ambient	375mW
Derating Factor	5mW/°C
Storage Temperature	−55°C to +150°C
Operating Temperature Range	−55°C to +100°C

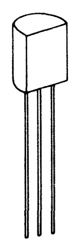
MECHANICAL SPECIFICATIONS

P13T1-P13T2



Dimensions in inches.

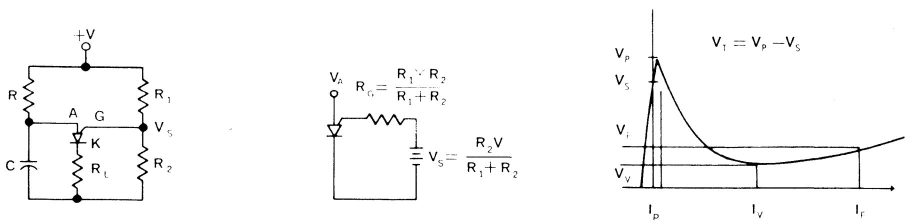
TO-92



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	P13T1 Min.	P13T1 Max.	P13T2 Min.	P13T2 Max.	Units	Test Conditions
Peak Current	I_P	1	— —	5 2	— —	1.0 0.15	μA μA	$R_G = 10k, V_s = 10V$ $R_G = 1\ M\Omega$
Valley Current	I_V	1	70 —	— 50	25 —	— 25	μA μA	$R_G = 10k, V_s = 10V$ $R_G = 1\ M\Omega$
Offset Voltage	V_T	1	0.2 0.2	0.6 1.6	0.2 0.2	0.6 0.6	V V	$R_G = 10k, V_s = 10V$ $R_G = 1\ M\Omega$
Gate-to-Anode Leakage	I_{GAO}	2	— —	10 100	— —	10 100	nA nA	$T = 25°C, V_s = 40V$ $T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_s = 40V$
Forward Voltage	V_F	4	—	1.0	—	1.0	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	9	—	9	—	V	
Pulse Output Rise Time	t_r	5	—	80	—	80	ns	



a) Typical Circuit

b) Equivalent Test Circuit

c) Characteristic Curve

Figure 1

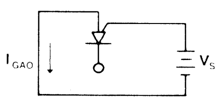


Figure 2

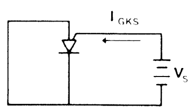


Figure 3

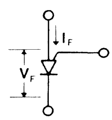


Figure 4

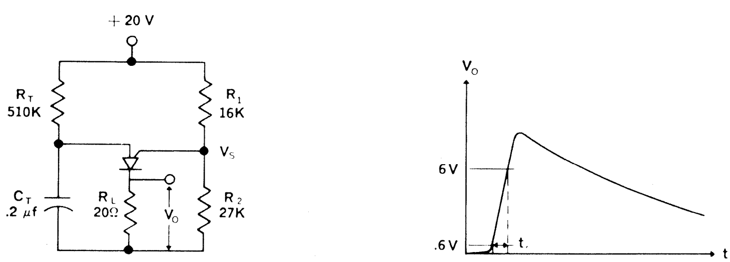


Figure 5

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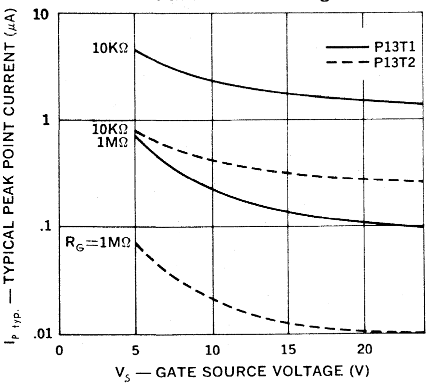
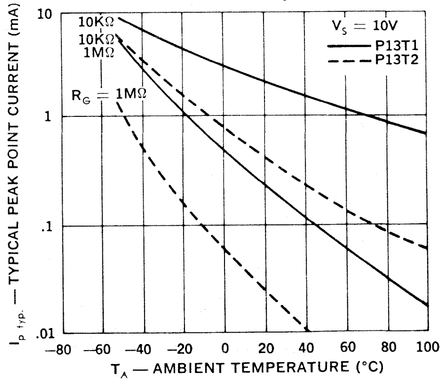
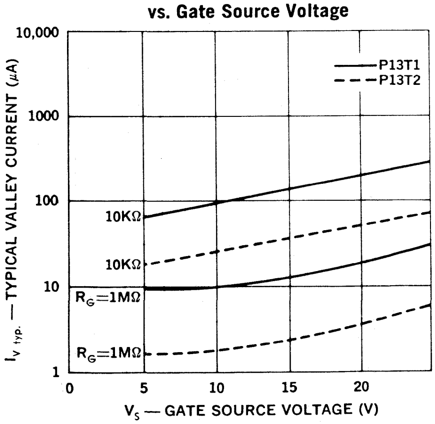
Typical Peak Point Current
vs. Gate Source Voltage



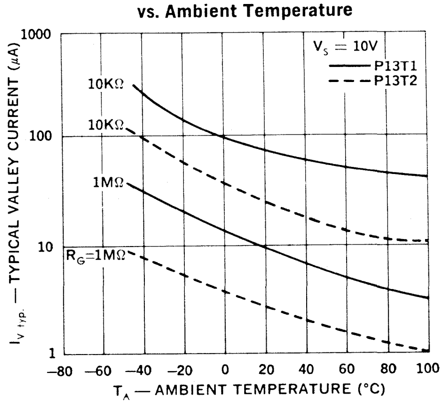
Typical Peak Point Current
vs. Ambient Temperature



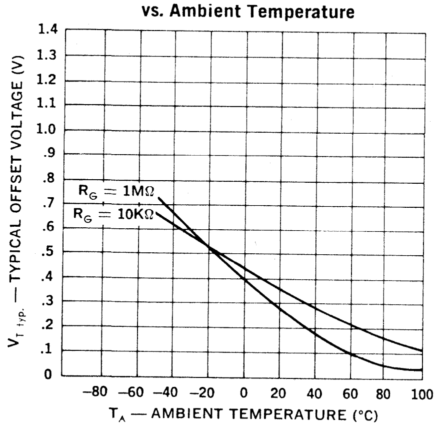
Typicai Valley Current
vs. Gate Source Voltage



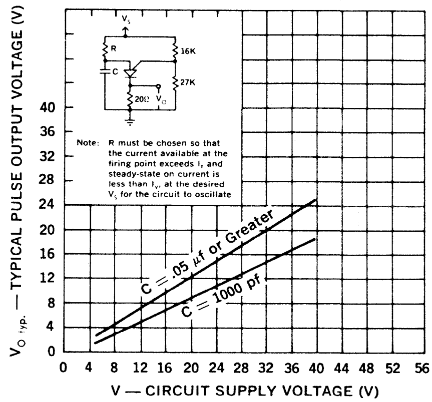
Typical Valley Current
vs. Ambient Temperature



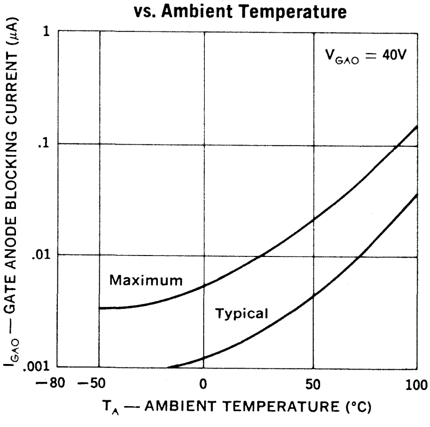
Typical Offset Voltage vs. Ambient Temperature



Typical Pulse Output vs. Circuit Supply Voltage



Gate-Anode Blocking Current vs. Ambient Temperature



Typical On-State Current vs. Voltage

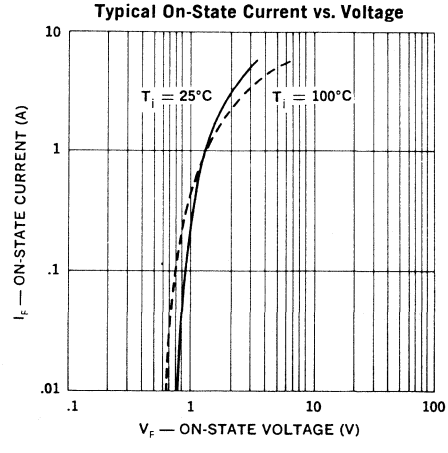


PHOTO-SCRs

Planar, Light Activated Switches

PF30-PF200
PF30A-PF200A

FEATURES

- Narrow Range of LTI: 2.5:1 in "A" Series
- High Noise Immunity: dv/dt of 50V/μs
- Inherent Binary Memory
- Trigger Level Set by Bias
- Flat Lens Permits Aperture Masking (PF Series)

DESCRIPTION

The PF 30 Series has a flat lens for wide-angle response.

The Photo SCR is an extremely efficient light-activated bi-stable switch. A single Photo SCR can often perform the dual role of light sensing and load actuating. With inherent binary memory the Photo SCR latches "on" with a light or electrical pulse and latches "off" when load current is momentarily interrupted. Light triggering level is set electrically with gate bias.

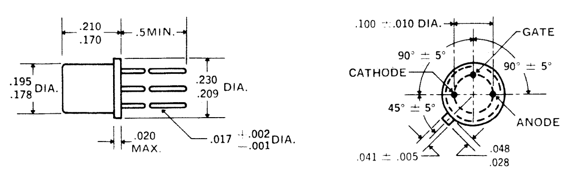
These Photo SCRs are ideal for use in punched tape and card readers, meter position sensing, intrusion alarms, flame detectors, optical tachometers and shaft encoders, level controls, slave flashes, watt-hour meters, isolation switches, and a wide variety of other light sensing applications.

ABSOLUTE MAXIMUM RATINGS

	PF30 PF30A	PF60 PF60A	PF100 PF100A	PF200 PF200A
Repetitive Peak Off-State Voltage, V_{DRM}	30V	60V	100V	200V
Repetitive Peak Reverse Voltage, V_{RRM}	30V	60V	100V	200V
DC On-State Current, I_T				
50°C Case	300mA			
50°C Ambient	150mA			
Peak One-Cycle Surge (Non-Repetitive) On-State Current, I_{TSM}	5A			
Peak Gate Current, I_{GM}	250mA			
Average Gate Current, $I_{G(AV)}$	25mA			
Reverse Gate Voltage, V_{GR}	5V			
Operating and Storage Temperature Range	−65°C to +125°C			

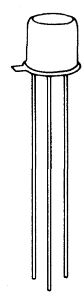
MECHANICAL SPECIFICATIONS

PF SERIES



Dimensions in inches.

TO-18
(FLAT LENS)



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Min.	Typical	Max.	Units	Test Conditions
Off-State Current	I_{DRM}	—	0.1	0.5	μA	V_{DRM} = Rating, R_{GK} = 4.7K
Reverse Current	I_{RRM}	—	0.1	0.5	μA	V_{RRM} = Rating, R_{GK} = 4.7K
Reverse Gate Current	I_{GR}	—	0.1	1.0	μA	V_{GR} = 2V
On-State Voltage	V_{TM}	—	1.0	1.5	V	I_T = 300mA (Pulsed)
Holding Current	I_H	50	500	1000	μA	R_{GK} = 4.7K
Light Trigger Intensity PF Series		20	30	50	ft. candles	V_D = +10V, R_{GK} =
		0.27	0.40	0.67	mW/cm²	27K, PF30-PF200
		150	250	400	ft. candles	V_D = +10V, R_{GK} =
"A" Types	λ_T	2.0	3.4	5.4	mW/cm²	27K, PF300-PF400
		125	200	300	ft. candles	V_D = +10V, R_{GK} =
		1.7	2.7	4.0	mW/cm²	4.7K, PF30-PF200
		10	20	50	ft. candles	V_D = +10V, R_{GK} =
		0.13	0.27	0.67	mW/cm²	27K, PF30-PF200
Non "A" Types	λ_T	75	200	400	ft. candles	V_D = +10V, R_{GK} =
		1.0	2.7	5.4	mW/cm²	27K, PF300-PF400
		50	150	300	ft. candles	V_D = +10V, R_{GK} =
		0.67	2.0	4.0	mW/cm²	4.7K, PF30-PF200
Anode Voltage — Critical Rate of Rise	dv/dt	—	50	—	V/μs	V_D = 30V, R_{GK} = 1.8K
		—	20	—	V/μs	V_D = 30V, R_{GK} = 4.7K
125°C Forward Blocking Current	I_{DRM}	—	2	25	μA	V_{DRM} = Rating, R_{GK} = 4.7K
125°C Reverse Blocking Current	I_{RRM}	—	2	25	μA	V_{RRM} = Rating, R_{GK} = 4.7K

Notes:
1. Voltage ratings apply over the full operating temperature range, provided the gate is connected to the cathode through an appropriate size resistor, or other adequate bias is used. See below for specific biasing techniques.
2. Color temperature of unfiltered incandescent light source is 2870°K.
3. 1 mw / cm² ≈ 75 foot candles at stated color temperature.

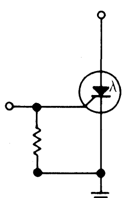
GATE BIAS CONSIDERATIONS

The Photo SCR is a very high gain device and should not be operated or tested with the gate open or floating. For operation up to 100°C junction temperature, a 27K resistor between gate and cathode, (See Figure 1), will provide adequate bias. For 125°C operation a 4.7K will suffice. Sensitivity can be reduced by decreasing this resistance.

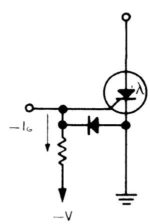
Sensitivity can be maximized, and made more uniform, over a wider range of ambient temperature by means of negative gate biasing as shown in Figure 2. Reducing gate bias current will increase light sensitivity, while increased gate bias can be employed to inhibit light triggering.

For electrical triggering, the gate trigger current (I_{GT}) is dependent on the bias used and the light incident on the photo SCR. With resistor bias, and no light, $I_{GT} = \frac{V_{GT}}{R_{GK}}$. When negative gate current ($-I_G$) bias is used with no light, the trigger current must first overcome I_G and an additional current of approximately 2μA will cause triggering.

Resistor Bias
Figure 1

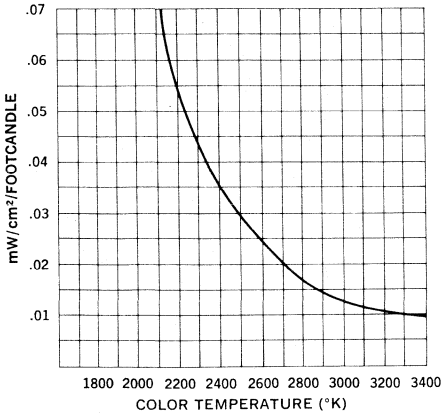


Negative Gate Bias
Figure 2

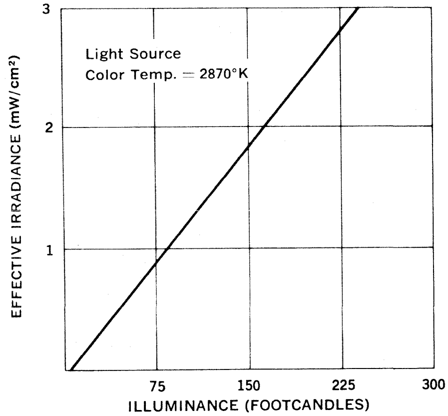


LIGHT SOURCE CHARACTERISTICS

1. Effective Irradiance/Footcandles for a Tungsten Lamp vs. Color Temperature



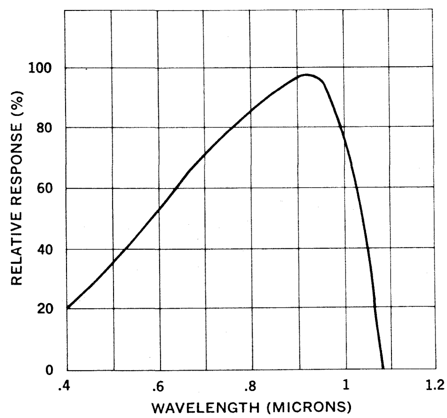
2. Effective Irradiance vs. Illuminance



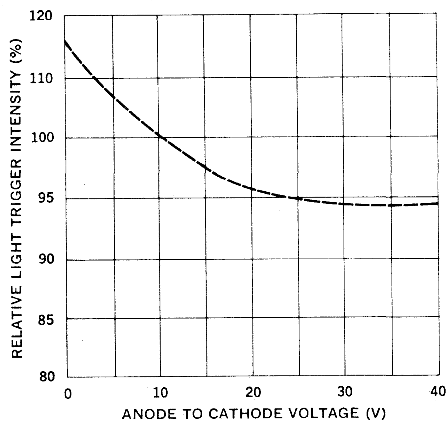
TYPICAL CHARACTERISTICS

Color temperature of unfiltered incandescent light source is 2870°K.

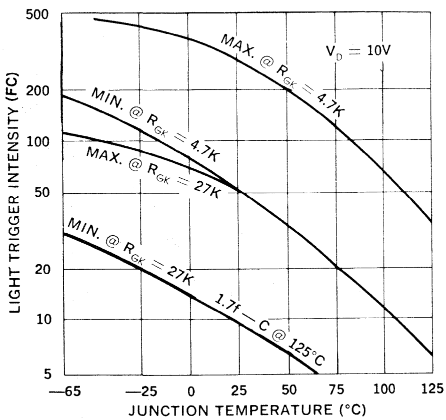
1. Spectral Response



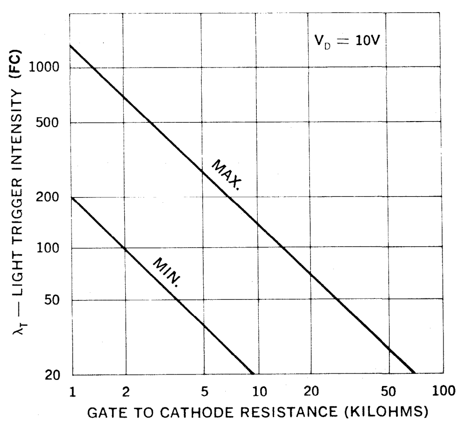
2. Relative Light Trigger Intensity vs. Anode Voltage



3. Light Trigger Intensity PF Series

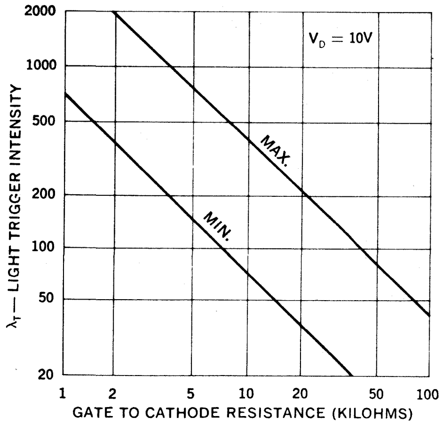


4. Light Trigger Intensity PF Series 25°C

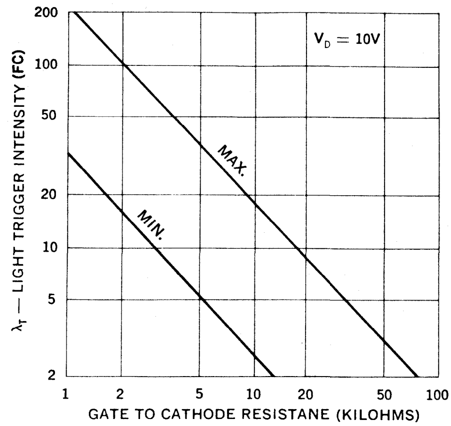


TYPICAL CHARACTERISTICS

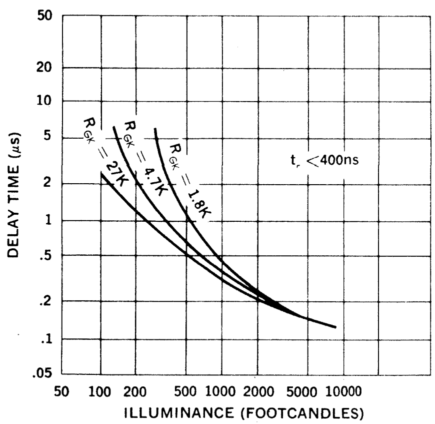
5. Light Trigger Intensity PF —55°C Series



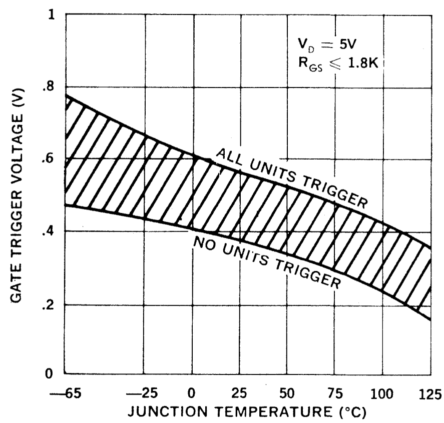
6. Light Trigger Intensity PF Series 125°C



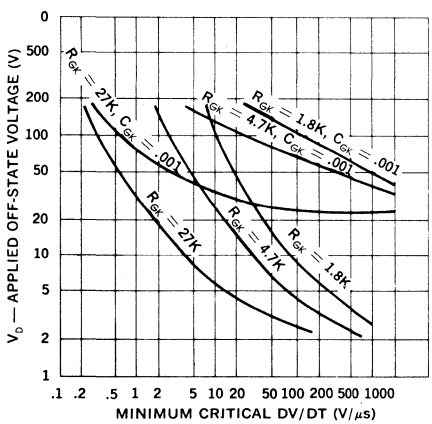
7. Delay Time vs. Illuminance PF Series



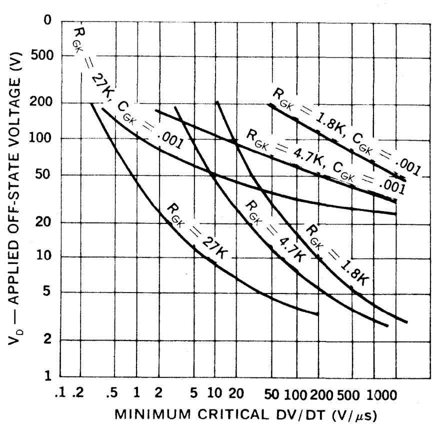
8. Gate Trigger Voltage



9. dv/dt at 25°C

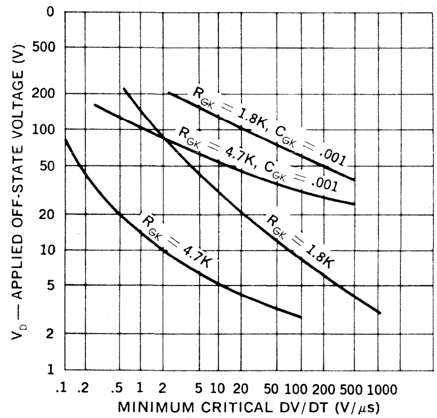


10. dv/dt at —55°C

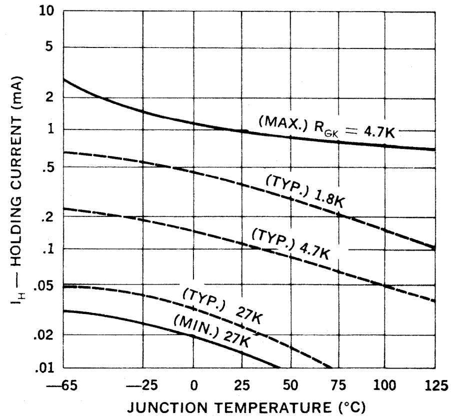


TYPICAL CHARACTERISTICS

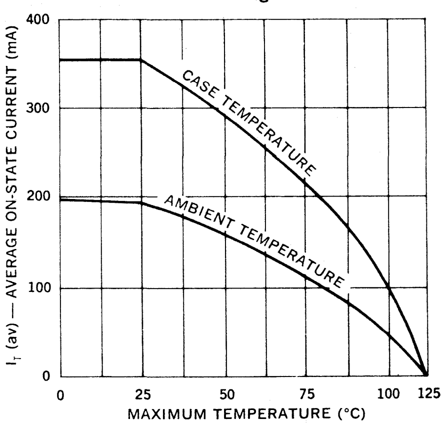
11. dv/dt at +125°C



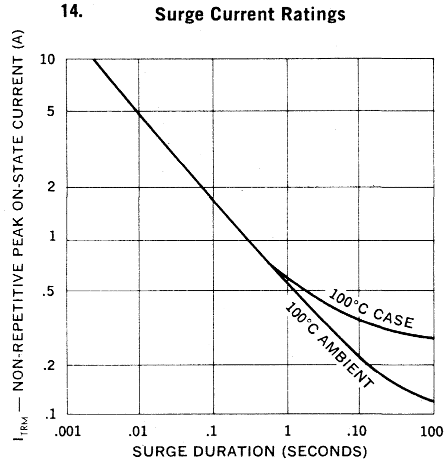
12. Holding Current (Resistor Bias)



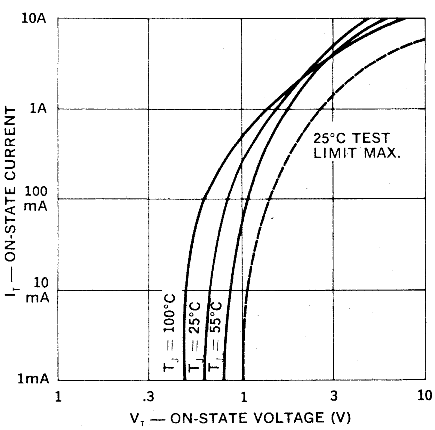
13. Continuous Current Ratings



14. Surge Current Ratings

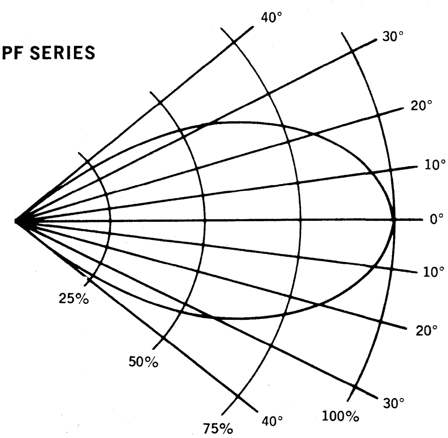


15. On-State Characteristics



ANGULAR RESPONSE

PF SERIES



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POWER INTEGRATED CIRCUIT

Switching Regulator 5 Amp Positive and Negative Power Output Stages

PIC600
PIC601
PIC602
PIC610
PIC611
PIC612

FEATURES

- Designed and characterized for switching regulator applications
- Cost saving design reduces size, improves efficiency, reduces noise and RFI (See note 4.)
- High operating frequency (to > 100kHz) results in smaller inductor-capacitor filter and improved power supply response time
- High operating efficiency: Typical 2A circuit performance —
  Rise and Fall time <75ns
  Efficiency >85%
- No reverse recovery spike generated by commutating diode (See note 4. and Fig. 2.)
- Electrically isolated, 4-Pin, TO-66 hermetic case

DESCRIPTION

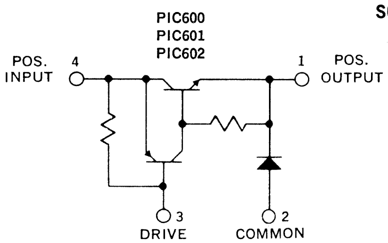
The Unitrode ESP Switching Regulator is a unique hybrid transistor circuit, specifically designed, constructed and specified for use in high current switching regulator applications. The designer is thus relieved of one of the most time consuming, tedious and critical aspects of switching regulator design: choosing the appropriate switching transistors and commutating diode, and empirically determining the optimum drive and bias conditions.

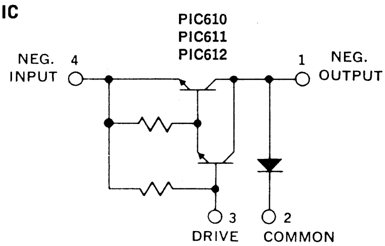
Switching regulators, when compared to conventional regulators, result in significant reductions in size, weight, and internal power losses and a major decrease in overall cost. Using the Unitrode PIC600 series, the designer can achieve further improvements in size, weight, efficiency, and costs. At the same time, because of the PIC600 series design and packaging, the designer is aided in overcoming two of the most significant drawbacks to switching regulators: noise generation and slow response time; there is, in fact, no diode reverse recovery spike (see note 4.).

The PIC600 series switching regulators are designed and characterized to be driven with standard integrated circuit voltage regulators. They are completely characterized over their entire operating range of —55°C to +125°C. The devices are enclosed in a special 4-pin TO-66 package, hermetically sealed for high reliability. The hybrid circuit construction utilizes thick film resistors on a beryllia substrate for maximum thermal conductivity and resultant low thermal impedance. All of the active elements in the hybrid are fully passivated.

Application Notes U-68 and U-76 provide a detailed description of the hybrid circuit and design guidance for specific circuit applications.

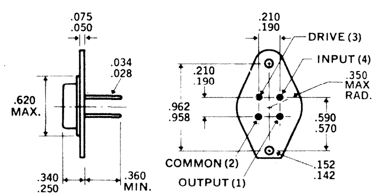
SCHEMATIC





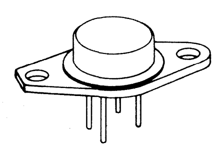
MECHANICAL SPECIFICATIONS

PIC600 PIC601 PIC602 PIC610 PIC611 PIC612



NOTES:
1. Case is electrically isolated.
2. Loads may be soldered to within 1/16" of base provided temperature-time exposure is less than 260°C for 10 seconds.

4-Pin TO-66



UNITRODE

ABSOLUTE MAXIMUM RATINGS

	PIC600	PIC601	PIC602	PIC610	PIC611	PIC612
Input Voltage, V_{4-2}	60V	80V	100V	—60V	—80V	—100V
Output Voltage, V_{1-2}	60V	80V	100V	—60V	—80V	—100V
Drive-Input Reverse Voltage, V_{3-4}	5V	5V	5V	—5V	—5V	—5V
Output Current, I_1	15A	5A	5A	—5A	—5A	—5A
Drive Current, I_3	—0.2A	—0.2A	—0.2A	0.2A	0.2A	0.2A

Thermal Resistance

Junction to Case, θ_{J-C}

Power Switch .... 4.0°C/W

Commutating Diode .... 4.0°C/W

Case to Ambient, θ_{C-A} .... 60.0°C/W

Operating Temperature Range, T_C .... —55°C to +125°C

Maximum Junction Temperature, T_j .... +150°C

Storage Temperature Range .... —65°C to +150°C

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC600, 601, 602 Min.	Typ.	Max.	PIC610, 611, 612 Min.	Typ.	Max.	Units	Conditions
Current Delay Time	t_{di}	—	20	40	—	20	40	ns	V_{in} = 25V(—25V)
Current Rise Time	t_{ri}	—	50	75	—	50	75	ns	V_{out} = 5V(—5V)
Voltage Rise Time	t_{rv}	—	30	50	—	30	50	ns	I_{out} = 2A(—2A)
Voltage Storage Time	t_{sv}	—	700	—	—	700	—	ns	I_3 = —20mA(20mA)
Voltage Fall Time	t_{fv}	—	50	75	—	50	75	ns	See Figure 2.
Current Fall Time	t_{fi}	—	70	150	—	70	150	ns	See notes 1., 2., 4.
Efficiency (Notes 2. & 4.)	η	—	85	—	—	85	—	%	
On-State Voltage (Note 3.)	$V_{4-1(on)}$	—	1.0	1.5	—	—1.0	—1.5	V	I_4 = 2A(—2A), I_3 = —.02A(.02A)
On-State Voltage (Note 3.)	$V_{4-1(on)}$	—	2.5	3.5	—	—2.5	—3.5	V	I_4 = 5A(—5A), I_3 = —.02A(.02A)
Diode Forward Voltage (Note 3.)	$V_{2-1(on)}$	—	.8	1.0	—	—.8	—1.0	V	I_2 = 2A(—2A)
Diode Forward Voltage (Note 3.)	$V_{2-1(on)}$	—	1.0	1.5	—	—1.0	—1.5	V	I_2 = 5A(—5A)
Off-State Current	I_{4-1}	—	0.1	10	—	—0.1	—10	μA	V_4 = Rated input voltage
Off-State Current	I_{4-1}	—	10	—	—	—10	—	μA	V_4 = Rated input voltage, T_A = 100°C
Diode Reverse Current	I_{1-2}	—	1.0	10	—	—1.0	—10	μA	V_1 = Rated output voltage
Diode Reverse Current	I_{1-2}	—	500	—	—	500	—	μA	V_1 = Rated output voltage, T_A = 100°C

Notes:
1. In switching an inductive load, the current will lead the voltage on turn-on and lag the voltage on turn-off (see Figure 2). Therefore, Voltage Delay Time (t_{DV}) ≅ t_{di} + t_{ri} and Current Storage Time (t_{si}) ≅ t_{sv} + t_{fv}.
2. The efficiency is a measure of internal power losses and is equal to Output Power divided by Input Power. The switching speed circuit of Figure 1, in which the efficiency is measured, is representative of typical operating conditions for the PIC600 series switching regulators.
3. Pulse test: Duration = 300ms, Duty Cycle ≤2%.
4. As can be seen from the switching waveforms shown in Figure 2, no reverse or forward recovery spike is generated by the commutating diode during switching! This reduces self-generated noise, since no current spike is fed through the switching regulator. It also improves efficiency and reliability, since the power switch only carries current during turn-on.

POWER DISSIPATION CONSIDERATIONS

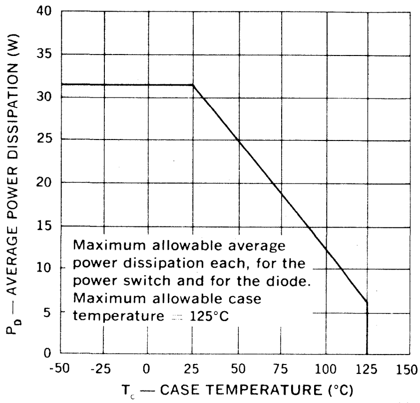
The total power losses in the switching regulator is the sum of the switching losses, and the power switch and diode D.C. losses. Once total power dissipation has been determined, the Power Dissipation curve, or thermal resistance data may be used to determine the allowable case or ambient temperature for any operating condition.

The switching losses curve presents data for a frequency of 20KHz. To find losses at any other frequency, multiply by f/20KHz.

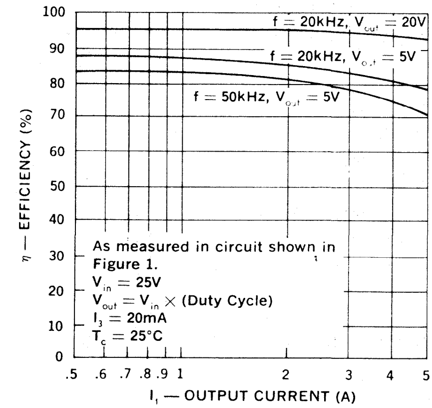
The D.C. losses curves present data for a duty cycle of .2. To find D.C. losses at any other duty cycle, multiply by D/.2 for the power switch and by (1-D)/.8 for the diode.

At frequencies much below 10KHz the above method for determining the allowable case or ambient temperature becomes invalid and a detailed transient thermal analysis must be performed. Please request Design Note 6 (DN-6) for further information.

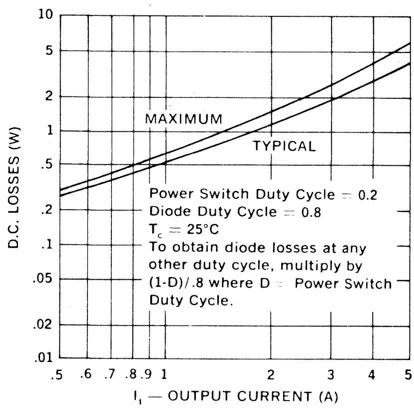
Power Dissipation



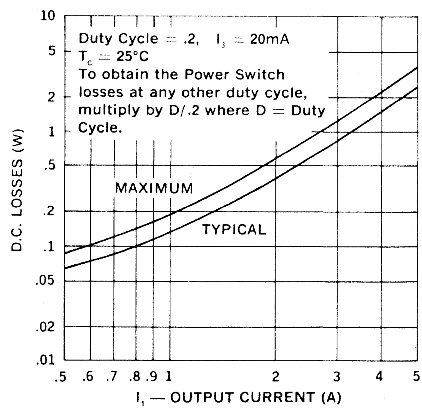
Efficiency



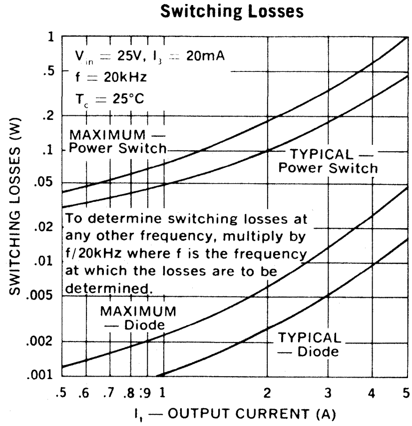
Diode D.C. Losses



Power Switch D.C. Losses



Switching Losses



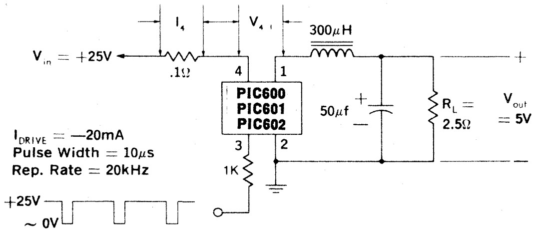


Figure 1. PIC600, 601, 602 Switching Speed Circuit

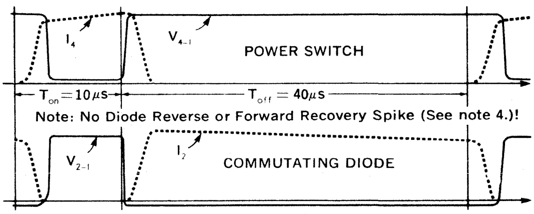
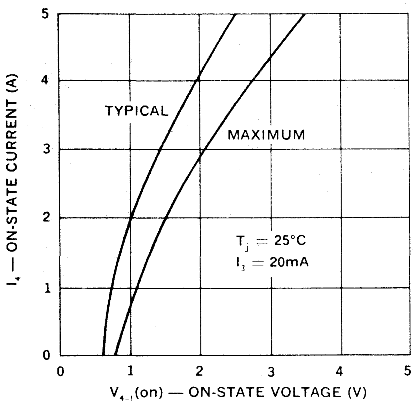


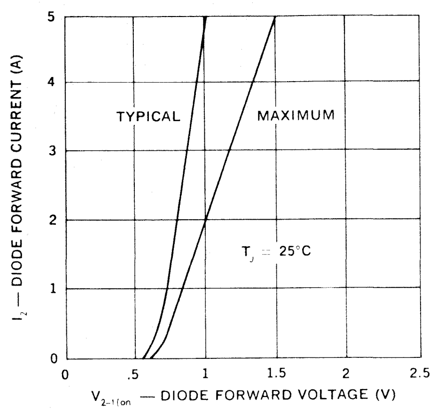
Figure 2. PIC600, PIC601, PIC602 Switching Waveforms

Note: PIC610, PIC611, PIC612 Test Circuit and waveforms are identical but of opposite polarity ($V_{in} = -25V$, $V_{out} = -5V$, $I_{DRIVE} = +20mA$).

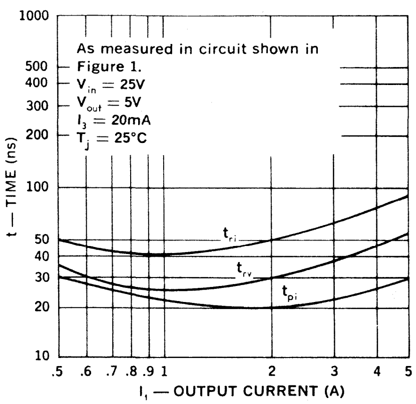
On-State Characteristics



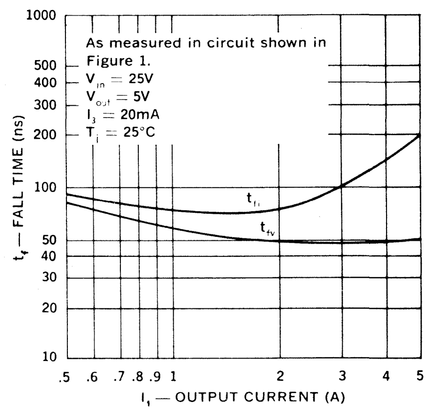
Diode Forward Characteristics



Turn-On Time



Fall Time



POWER INTEGRATED CIRCUIT

Switching Regulator 15 Amp Positive and Negative Power Output Stages

PIC625
PIC626
PIC627
PIC635
PIC636
PIC637

FEATURES

- Designed and characterized for switching regulator applications
- Cost saving design reduces size, improves efficiency, reduces noise and RFI (See note 4.)
- High operating frequency (to >100kHz) results in smaller inductor-capacitor filter and improved power supply response time
- High operating efficiency: Typical 7A circuit performance —
  Rise and Fall time <300 ns
  Efficiency >85%
- No reverse recovery spike generated by commutating diode (See note 4. and Fig. 2.)
- Electrically isolated, 4-Pin, TO66 hermetic case

DESCRIPTION

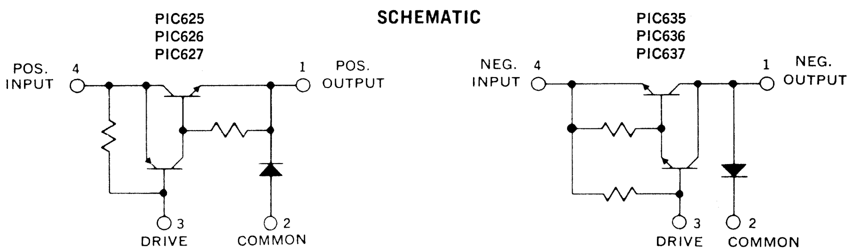
The Unitrode ESP Switching Regulator is a unique hybrid transistor circuit, specifically designed, constructed and specified for use in high current switching regulator applications. The designer is thus relieved of one of the most time consuming, tedious and critical aspects of switching regulator design: choosing the appropriate switching transistors and commutating diode, and empirically determining the optimum drive and bias conditions.

Switching regulators, when compared to conventional regulators, result in significant reductions in size, weight, and internal power losses and a major decrease in overall cost. Using the Unitrode PIC600 series the designer can achieve further improvements in size, weight, efficiency, and costs. At the same time, because of the PIC600 series design and packaging, the designer is aided in overcoming two of the most significant drawbacks to switching regulators: noise generation and slow response time; there is, in fact, no diode reverse recovery spike (See note 4.).

The PIC600 series switching regulators are designed and characterized to be driven wih standard integrated circuit voltage regulators. They are completely characterized over their entire operating range of −55°C to +125°C. The devices are enclosed in a special 4-pin TO66 package, hermetically sealed for high reliability. The hybrid circuit construction utilizes thick film resistors on a beryllia substrate for maximum thermal conductivity and resultant low thermal impedance. All of the active elements in the hybrid are fully passivated.

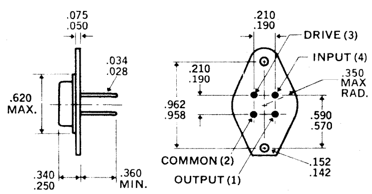
Application Notes U-68 and U-76 provide a detailed description of the hybrid circuit and design guidance for specific circuit applications.

SCHEMATIC



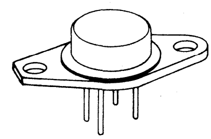
MECHANICAL SPECIFICATIONS

PIC625 PIC626 PIC627 PIC635 PIC636 PIC637



NOTES:
1. Case is electrically isolated.
2. Loads may be soldered to within 1/16″ of base provided temperature-time exposure is less than 260°C for 10 seconds.

4-Pin TO-66



UNITRODE

ABSOLUTE MAXIMUM RATINGS

	PIC625	PIC626	PIC627	PIC635	PIC636	PIC637
Input Voltage, V_{4-2}	60V	80V	100V	—60V	—80V	—100V
Output Voltage, V_{1-2}	60V	80V	100V	—60V	—80V	—100V
Drive-Input Reverse Voltage, V_{3-4}	5V	5V	5V	—5V	—5V	—5A
Output Current, I_1	5A	15A	15A	—15A	—15A	—15A
Drive Current, I_3	—0.4A	—0.4A	—0.4A	0.4A	0.4A	0.4A

Thermal Resistance

Junction to Case, Θ_{J-C}

Power Switch .... 4.0°C/W

Commutating Diode .... 4.0°C/W

Case to Ambient, Θ_{C-A} .... 60.0°C/W

Operating Temperature Range, T_C .... —55°C to +125°C

Maximum Junction Temperature, T_J .... +150°C

Storage Temperature Range .... —65°C to +150°C

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC625/626/627 Min.	Typ.	Max.	PIC635/636/637 Min.	Typ.	Max.	Units	Conditions
Current Delay Time	t_{di}	—	35	60	—	35	60	ns	$V_{in} = 25V(-25V)$
Current Rise Time	t_{ri}	—	65	150	—	65	175	ns	$V_{out} = 5V(-5V)$
Voltage Rise Time	t_{rv}	—	40	60	—	40	60	ns	$I_{out} = 7A(-7A)$
Voltage Storage Time	t_{sv}	—	900	—	—	900	—	ns	$I_3 = -30mA(30mA)$
Voltage Fall Time	t_{fv}	—	70	175	—	100	300	ns	See Figure 2
Current Fall Time	t_{fi}	—	175	300	—	175	300	ns	See notes 1, 2, 4
Efficiency (Notes 2 and 4)	η	—	85	—	—	85	—	%	
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	1.0	1.5	—	—1.0	—1.5	V	$I_4 = 7A(-7A)$, $I_3 = -.03A(.03A)$
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	2.5	3.5	—	—2.5	—3.5	V	$I_4 = 15A(-15A)$, $I_3 = -.03A(.03A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.85	1.25	—	—.85	—1.25	V	$I_2 = 7A(-7A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.95	1.75	—	—.95	—1.75	V	$I_2 = 15A(-15A)$
Off-State Current	I_{4-1}	—	0.1	10	—	—0.1	—10	μA	V_4 = Rated input voltage
Off-State Current	I_{4-1}	—	10	—	—	—10	—	μA	V_4 = Rated input voltage, $T_A = 100°C$
Diode Reverse Current	I_{1-2}	—	1.0	10	—	—1.0	—10	μA	V_1 = Rated output voltage
Diode Reverse Current	I_{1-2}	—	500	—	—	500	—	μA	V_1 = Rated output voltage, $T_A = 100°C$

Notes:

1. In switching an inductive load, the current will lead the voltage on turn-on and lag the voltage on turn-off (see Figure 2.). Therefore, Voltage Delay Time (t_{DV}) $\simeq t_{di} + t_{ri}$ and Current Storage Time (t_{si}) $\simeq t_{sv} + t_{fv}$.
2. The efficiency is a measure of internal power losses and is equal to Output Power divided by Input Power. The switching speed circuit of Figure 1., in which the efficiency is measured, is representative of typical operating conditions for the PIC600 series switching regulators.
3. Pulse test: Duration = 300ms, Duty Cycle ≤2%.
4. As can be seen from the switching waveforms shown in Figure 2., no reverse or forward recovery spike is generated by the commutating diode during switching! This reduces self-generated noise, since no current spike is fed through the switching regulator. It also improves efficiency and reliability, since the power switch only carries current during turn-on.

POWER DISSIPATION CONSIDERATIONS

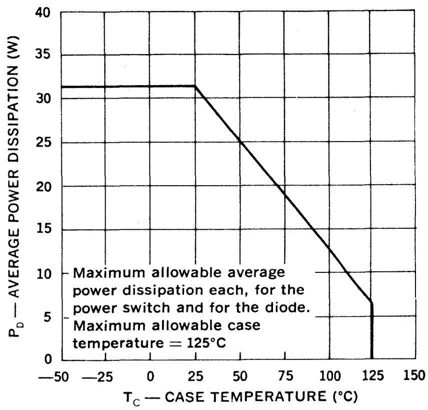
The total power losses in the switching regulator is the sum of the switching losses, and the power switch and diode D.C. losses. Once total power dissipation has been determined, the Power Dissipation curve, or thermal resistance data may be used to determine the allowable case or ambient temperature for any operating condition.

The switching losses curve presents data for a frequency of 20KHz. To find losses at any other frequency, multiply by f/20KHz.

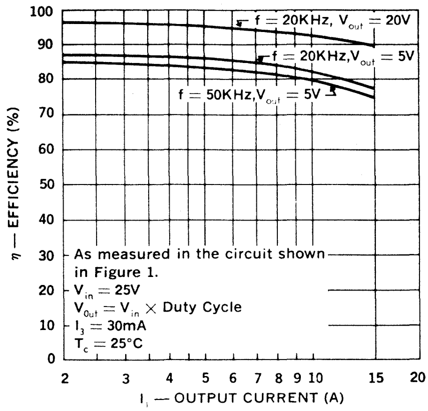
The D.C. losses curves present data for a duty cycle of .2. To find D.C. losses at any other duty cycle, multiply by D/.2 for the power switch and by (1-D)/.8 for the diode.

At frequencies much below 10KHz the above method for determining the allowable case or ambient temperature becomes invalid and a detailed transient thermal analysis must be performed. Please request Design Note 6 (DN-6) for further information.

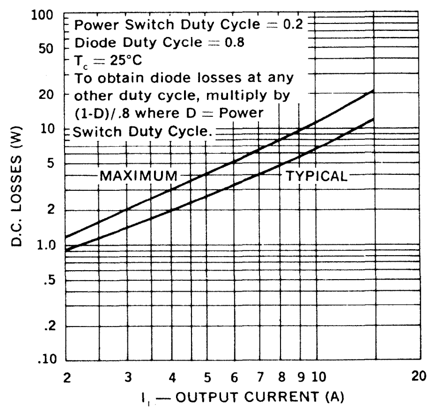
Power Dissipation



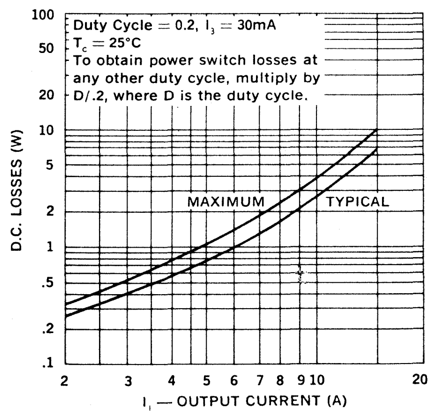
Efficiency



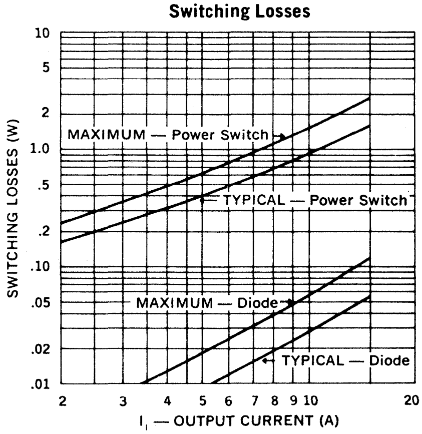
Diode D.C. Losses



Power Switch D.C. Losses



Switching Losses



V_{in} = 25V, I_3 = 30mA
f = 20KHz
T_C = 25°C
To determine switching losses at any other frequency, multiply by f/20KHz where f is the frequency at which the losses are to be determined.

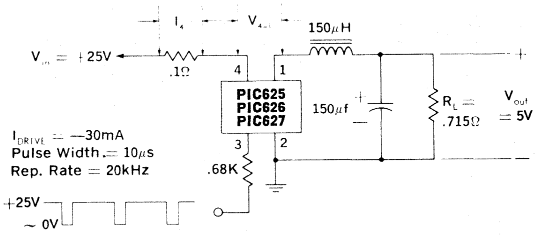


Figure 1. PIC625, 626, 627 Switching Speed Circuit

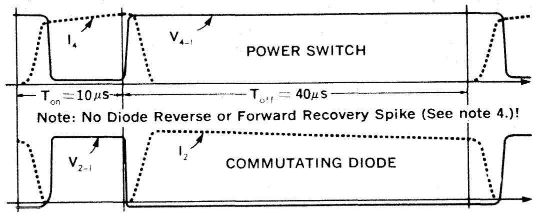
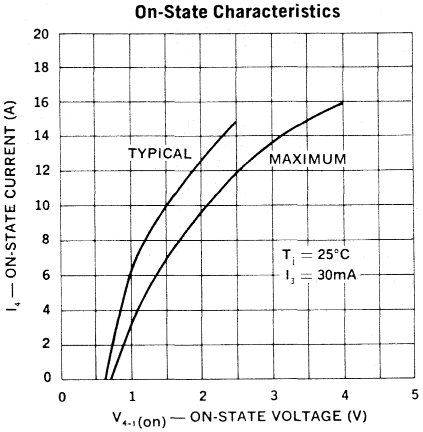


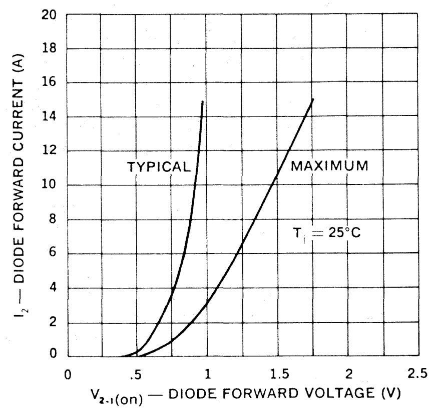
Figure 2. PIC625, 626, 627 Switching Waveforms

Note: PIC635, PIC636, PIC637 Circuit and waveforms are identical but of opposite polarity (V_{in} = —25V, V_{out} = —5V, I_{DRIVE} = +30mA.)

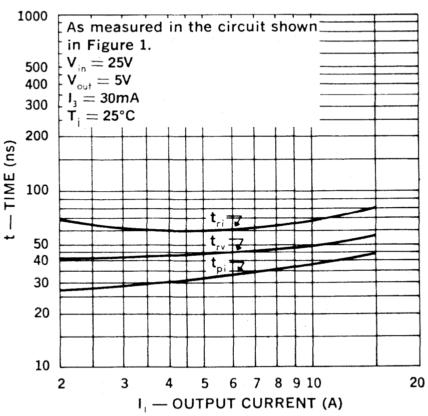
On-State Characteristics



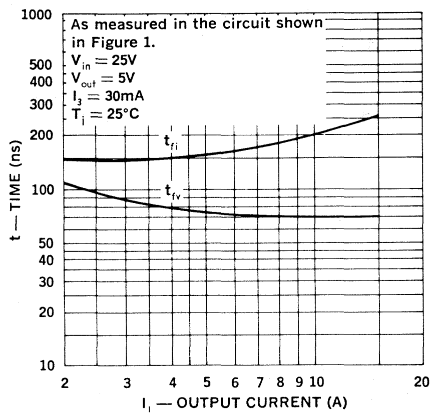
Diode Forward Characteristics



Turn-on Time



Fall Time



POWER INTEGRATED CIRCUIT

Switching Regulator 15 Amp Positive and Negative Power Output Stages

PIC645
PIC646
PIC647
PIC655
PIC656
PIC657

FEATURES

- Designed and characterized for switching regulator applications
- Cost saving design reduces size, improves efficiency, reduces noise and RFI (See note 4.)
- High operating frequency (to >100kHz) results in smaller inductor-capacitor filter and improved power supply response time
- High operating efficiency: Typical 7A circuit performance —
  Rise and Fall time <300 ns
  Efficiency >85%
- No reverse recovery spike generated by commutating diode (See note 4. and Fig. 2.)

DESCRIPTION

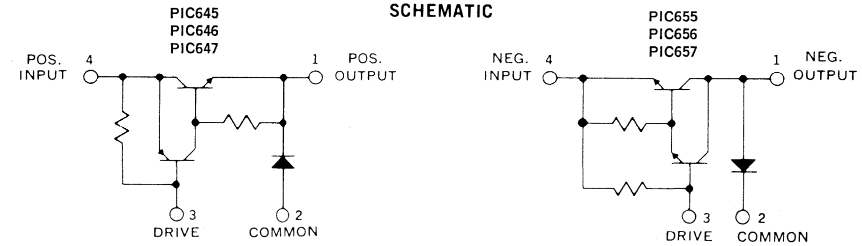
The Unitrode ESP Switching Regulator is a unique hybrid transistor circuit, specifically designed, constructed and specified for use in high current switching regulator applications. The designer is thus relieved of one of the most time consuming, tedious and critical aspects of switching regulator design: choosing the appropriate switching transistors and commutating diode, and empirically determining the optimum drive and bias conditions.

Switching regulators, when compared to conventional regulators, result in significant reductions in size, weight, and internal power losses and a major decrease in overall cost. Using the Unitrode PIC600 series the designer can achieve further improvements in size, weight, efficiency, and costs. At the same time, because of the PIC600 series design and packaging, the designer is aided in overcoming two of the most significant drawbacks to switching regulators: noise generation and slow response time; there is, in fact, no diode reverse recovery spike (See note 4.).

The PIC600 series switching regulators are designed and characterized to be driven with standard integrated circuit voltage regulators. They are completely characterized over their entire operating range of −55°C to +125°C. The devices are enclosed in a special 3 pin TO-3 package, hermetically sealed for high reliability. The hybrid circuit construction utilizes thick film resistors on a beryllia substrate for maximum thermal conductivity and resultant low thermal impedance. All of the active elements in the hybrid are fully passivated.

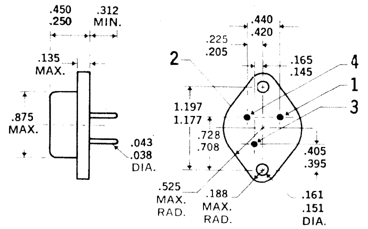
Application Notes U-68 and U-76 provide a detailed description of the hybrid circuit and design guidance for specific circuit applications.

SCHEMATIC



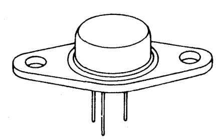
MECHANICAL SPECIFICATIONS

PIC645 PIC646 PIC647 PIC655 PIC656 PIC657



NOTE:
Loads may be soldered to within 1/16" of base provided temperature-time exposure is less than 260°C for 10 seconds.

3 Pin TO-3



UNITRODE

ABSOLUTE MAXIMUM RATINGS

	PIC645	PIC646	PIC647	PIC655	PIC656	PIC657
Input Voltage, V_{4-2}	60V	80V	100V	—60V	—80V	—100V
Output Voltage, V_{1-2}	60V	80V	100V	—60V	—80V	—100V
Drive-Input Reverse Voltage, V_{3-4}	5V	5V	5V	—5V	—5V	—5V
Continuous Output Current, I_1	15A	15A	15A	—15A	—15A	—15A
Peak Output Current	20A	20A	20A	—20A	—20A	—20A
Drive Current, I_3	—0.4A	—0.4A	—0.4A	0.4A	0.4A	0.4A

Thermal Resistance
- Junction to Case, Θ_{J-C}
  - Power Switch .... 2°C/W
  - Commutating Diode .... 2°C/W
- Case to Ambient, Θ_{C-A} .... 30.0°C/W

Operating Temperature Range, T_C .... —55°C to +125°C

Maximum Junction Temperature, T_j .... +150°C

Storage Temperature Range .... —65°C to +150°C

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	PIC645/646/647 Min.	Typ.	Max.	PIC655/656/657 Min.	Typ.	Max.	Units	Conditions
Current Delay Time	t_{di}	—	35	60	—	35	60	ns	$V_{in} = 25V(-25V)$
Current Rise Time	t_{ri}	—	65	150	—	65	175	ns	$V_{out} = 5V(-5V)$
Voltage Rise Time	t_{rv}	—	40	60	—	40	60	ns	$I_{out} = 7A(-7A)$
Voltage Storage Time	t_{sv}	—	900	—	—	900	—	ns	$I_3 = -30mA(30mA)$
Voltage Fall Time	t_{fv}	—	70	175	—	100	300	ns	See Figure 2
Current Fall Time	t_{fi}	—	175	300	—	175	300	ns	See notes 1, 2, 4
Efficiency (Notes 2 and 4)	η	—	85	—	—	85	—	%	
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	1.0	1.5	—	—1.0	—1.5	V	$I_4 = 7A(-7A)$, $I_3 = -.03A(.03A)$
On-State Voltage (Note 3)	$V_{4-1(on)}$	—	2.5	3.5	—	—2.5	—3.5	V	$I_4 = 15A(-15A)$, $I_3 = -.03A(.03A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.85	1.25	—	—.85	—1.25	V	$I_2 = 7A(-7A)$
Diode Fwd. Voltage (Note 3)	$V_{2-1(on)}$	—	.95	1.75	—	—.95	—1.75	V	$I_2 = 15A(-15A)$
Off-State Current	I_{4-1}	—	0.1	10	—	—0.1	—10	μA	V_4 = Rated input voltage
Off-State Current	I_{4-1}	—	10	—	—	—10	—	μA	V_4 = Rated input voltage, $T_A = 100°C$
Diode Reverse Current	I_{1-2}	—	1.0	10	—	—1.0	—10	μA	V_1 = Rated output voltage
Diode Reverse Current	I_{1-2}	—	500	—	—	500	—	μA	V_1 = Rated output voltage, $T_A = 100°C$

Notes:
1. In switching an inductive load, the current will lead the voltage on turn-on and lag the voltage on turn-off (see Figure 2.). Therefore, Voltage Delay Time (t_{DV}) $\cong t_{di} + t_{ri}$ and Current Storage Time (t_{si}) $\cong t_{sv} + t_{fv}$.
2. The efficiency is a measure of internal power losses and is equal to Output Power divided by Input Power. The switching speed circuit of Figure 1., in which the efficiency is measured, is representative of typical operating conditions for the PIC600 series switching regulators.
3. Pulse test: Duration = 300ms, Duty Cycle ≤2%.
4. As can be seen from the switching waveforms shown in Figure 2., no reverse or forward recovery spike is generated by the commutating diode during switching! This reduces self-generated noise, since no current spike is fed through the switching regulator. It also improves efficiency and reliability, since the power switch only carries current during turn-on.

POWER DISSIPATION CONSIDERATIONS

The total power losses in the switching regulator is the sum of the switching losses, and the power switch and diode D.C. losses. Once total power dissipation has been determined, the Power Dissipation curve, or thermal resistance data may be used to determine the allowable case or ambient temperature for any operating condition.

The switching losses curve presents data for a frequency of 20KHz. To find losses at any other frequency, multiply by f/20KHz.

The D.C. losses curves present data for a duty cycle of .2. To find D.C. losses at any other duty cycle, multiply by D/.2 for the power switch and by (1-D)/.8 for the diode.

At frequencies much below 10KHz the above method for determining the allowable case or ambient temperature becomes invalid and a detailed transient thermal analysis must be performed. Please request Design Note 6 (DN-6) for further information.

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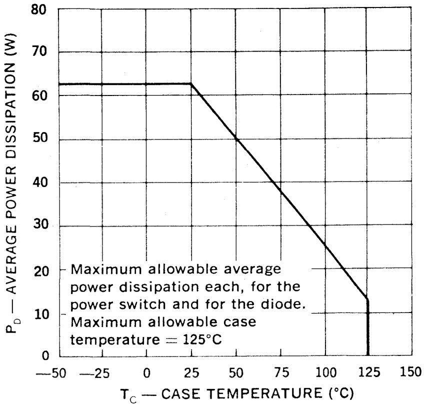
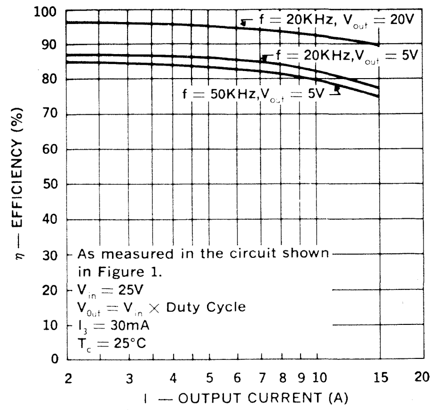
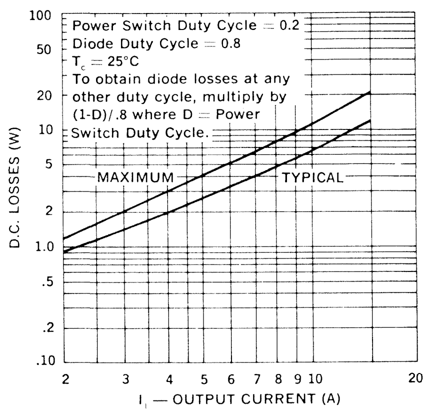
Power Dissipation



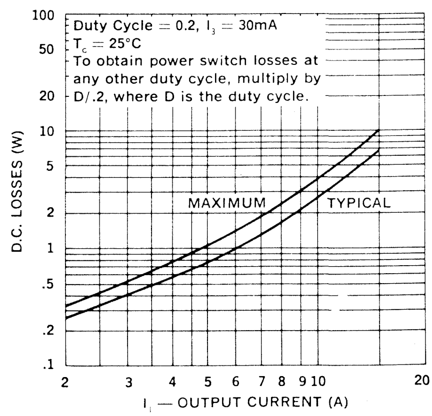
Efficiency



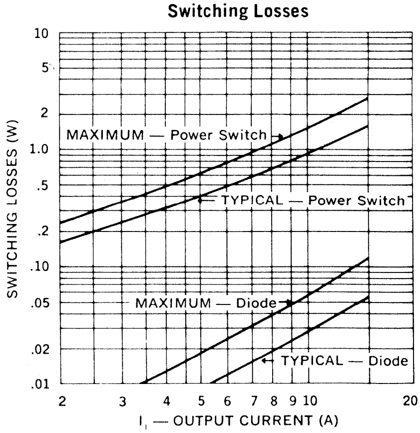
Diode D.C. Losses



Power Switch D.C. Losses



Switching Losses



V_{in} = 25V, I_3 = 30mA
f = 20KHz
T_C = 25°C
To determine switching losses at any other frequency, multiply by f/20KHz where f is the frequency at which the losses are to be determined.

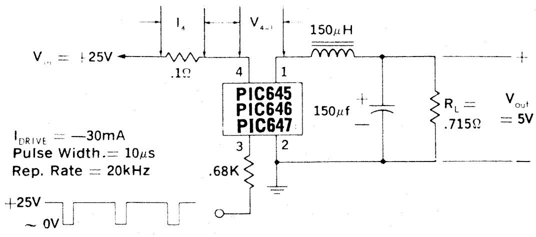


Figure 1. PIC645, 646, 647 Switching Speed Circuit

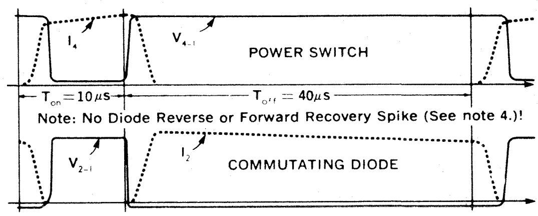
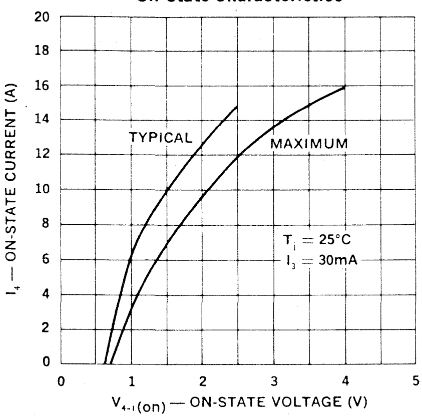


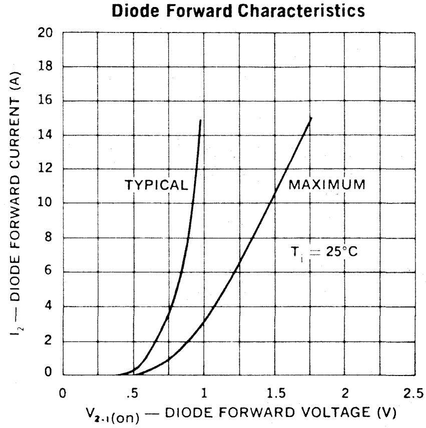
Figure 2. PIC645, 646, 647 Switching Waveforms

Note: PIC655, PIC656, PIC657 Circuit and waveforms are identical but of opposite polarity (V_{in} = −25V, V_{out} = −5V, I_{DRIVE} = +30mA.)

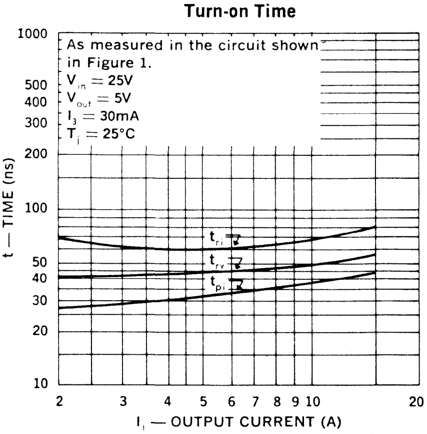
On-State Characteristics



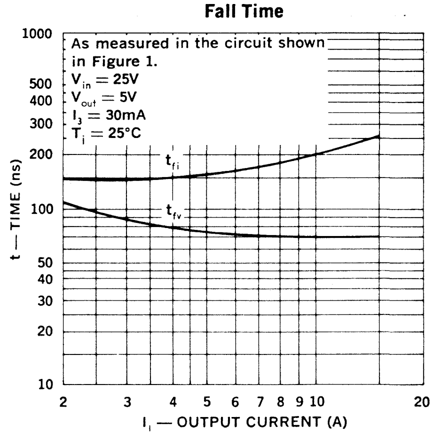
Diode Forward Characteristics



Turn-on Time



Fall Time



POWER SCHOTTKY RECTIFIERS

SD51

120A Pk, 45V

FEATURES

- Very Low Forward Drop (0.6V at 60A, 125°C)
- Low Recovered Charge
- Rugged Package Design (DO-5)
- High Efficiency for Low Voltage Supplies

DESCRIPTION

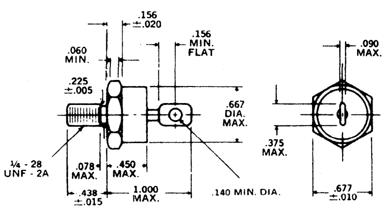
The SD51 has a Schottky barrier junction and is ideally suited for output rectifiers and catch diodes in low voltage power supplies. The Unitrode high conductivity design, using a heavy copper top post and a 4 point crimp, ensures cool terminal operation and low dynamic impedance. Rugged design absorbs stress that can damage glass-to-metal seal during installation and use.

ABSOLUTE MAXIMUM RATINGS (T_{CASE} = 25°C)

Rating	Symbol	Limit	Units
Working Peak Reverse Voltage	V_{RWM}	45	Volts
DC Blocking Voltage	V_R	45	Volts
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 KHz, 50 percent Duty Cycle)	I_{FRM}	120	Amp
Non-repetitive Peak Surge Current (8.3 mS)	I_{FSM}	800	Amp
Storage Temperature Range	T_{stg}	−55 to +165	°C
Junction Operating Temperature Range	T_j	−55 to +150	°C
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.0	°C/W

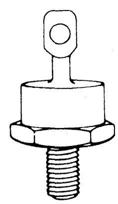
MECHANICAL SPECIFICATIONS

SD51



Dimensions in inches.

DO-5



Notes:

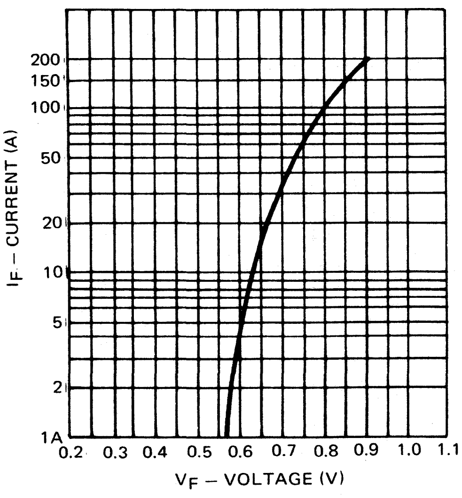
1. Cathode is stud.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

UNITRODE

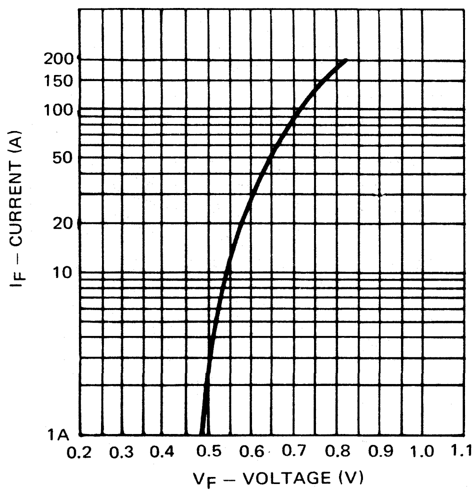
ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C)

Characteristic	Symbol	Limit	Units	Conditions
Maximum Instantaneous Reverse Current	i_R	200	mA	v_R = 35V T_C = 125°C Pulse Width = 400μs, Duty Cycle = 1 percent
Maximum Instantaneous Forward Voltage	v_F	0.60	Volts	i_F = 60A T_C = 125°C Pulse Width = 300μs, Duty Cycle = 1 percent
Maximum Capacitance	C_t	4000	pF	V_R = 5.0V
Minimum Rate of Change of Voltage	dv/dt	700	v/μs	v_R = 35V

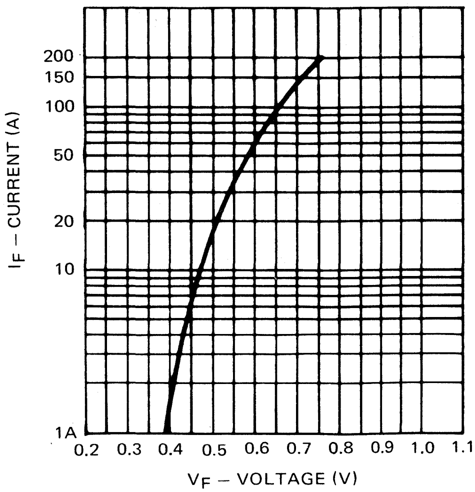
Typical Forward Current versus Forward Voltage
T_{CASE} = −55°C



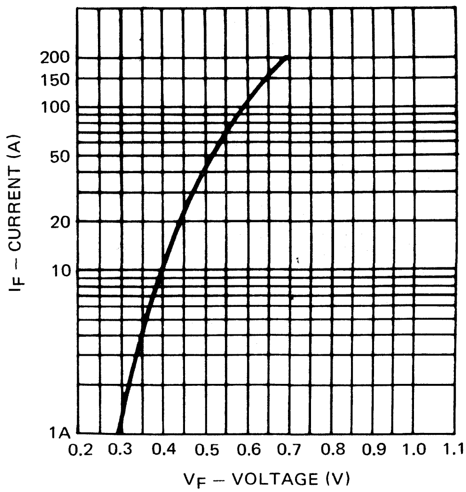
Typical Forward Current versus Forward Voltage
T_{CASE} = 25°C



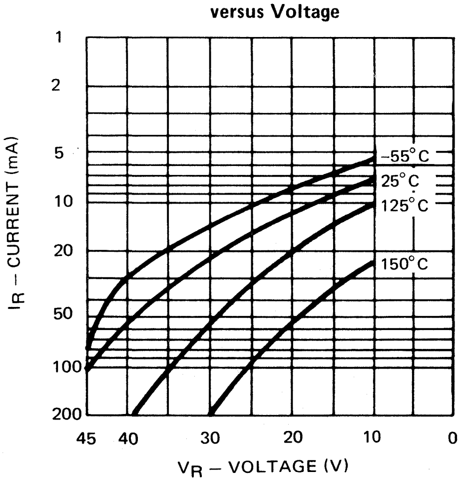
Typical Forward Current versus Forward Voltage T_{CASE} = 75°C



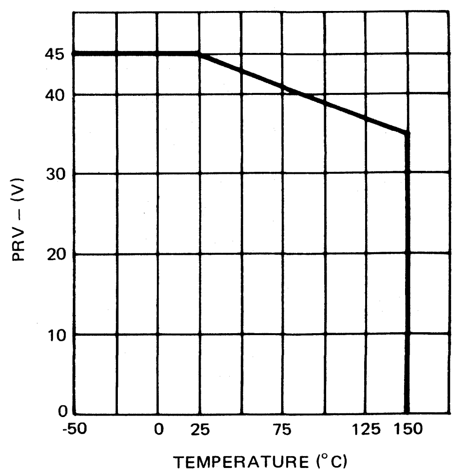
Typical Forward Current versus Forward Voltage T_{CASE} = 125°C



Typical Reverse Current versus Voltage



V_R (MAX) Rating versus Case Temperature



UNITRODE CORPORATION • 580 PLEASANT ST.
WATERTOWN, MASS. 02172 • TEL. (617) 926-0404
TWX (710) 327-1296 • TELEX 922-414

PRINTED IN U.S.A.

RECTIFIER ASSEMBLIES

Single Phase Bridges, 25 Amp, Military Approved

JAN SPA25
JAN SPB25
JAN SPC25
JAN SPD25

FEATURES
- Qualified to MIL-S-19500/446
- Current Rating: to 25A
- PIV: from 100 to 600V
- Surge Ratings: to 150A
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Aluminum Heat Sink Case, Electrically Insulated

DESCRIPTION
This series of military high-current single-phase bridges offer the utmost in reliability as required in military system designs. This series is assembled with diodes which have been subjected to 100% screening tests.

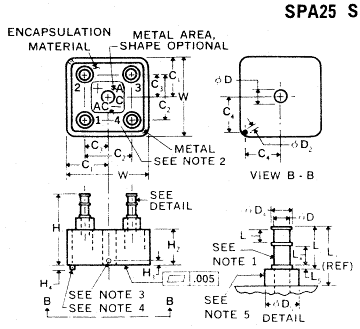
ABSOLUTE MAXIMUM RATINGS

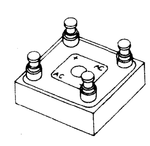
Peak Inverse Voltage .... 100 to 600V
Maximum Average D.C. Output Current
@ $T_C = 55°C$ 25A
@ $T_C = 100°C$ 15A
Non-Repetitive Sinusoidal Surge (8.3ms)
@ $T_C = 55°C$ 150A
Operating and Storage Temperature Range .... —65°C to +150°C
Thermal Resistance Junction to Ambient .... 20°C/W
Junction to Case .... 2.5°C/W

Ltr	Dimensions			
	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
C_1	.552	.572	14.02	14.53
C_2	.624	.760	15.85	19.30
C_3	.312	.380	7.92	9.65
C_4	.495	.512	12.57	13.00
ϕD_1	.189	.195	4.80	4.95
ϕD_2	.057	.067	1.45	1.70
ϕD_3	.108	.118	2.74	3.00
ϕD_4	.141	.151	3.58	3.84
ϕD_5	.225	.235	5.72	5.97
H_1	.669	1.060	17.53	26.92
H_2	.300	.500	7.62	12.70
H_3	.040	.060	1.02	1.52
H_4	.042	.062	1.07	1.57
L_1	.370	.560	9.40	14.22
L_2	.307	.365	7.80	9.27
L_3	.089	.099	2.26	2.49
L_4	.132	.142	3.35	3.61
L_5	.026	.036	.66	.91
W	1.104	1.144	28.04	29.06

MECHANICAL SPECIFICATIONS

SPA25 SPB25 SPC25 SPD25





NOTES:
1. Terminals shall be hot tin dipped or silver plated.
2. Polarity shall be marked on terminal side of device.
3. Point at which T_C is read (must be in metal part of case).
4. Locating pin shall be adjacent to positive terminal.
5. Insulating sleeve shall be alumina (AL_2O_3) or equivalent.

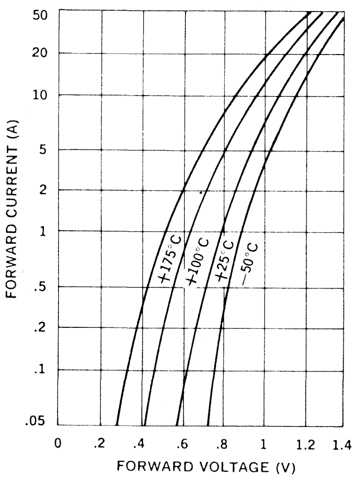
UNITRODE

Electrical Specifications (at 25°C unless noted)

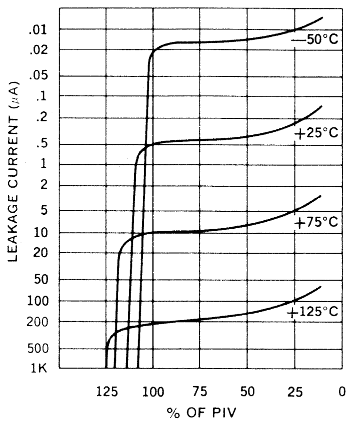
Type	PIV Per Leg	Peak Forward Voltage Drop*		Maximum Reverse Recovery Time†	Maximum Leakage Current Per Leg @ PIV	
					$T_C = 25°C$	$T_C = 150°C$
	Volts	Minimum	Maximum	μS	μA	μA
JAN SPA25 JAN SPB25 JAN SPC25 JAN SPD25	100 200 400 600	0.9V @ 39A(pk)	1.4V @ 39A(pk)	2	2	250

*Peak forward voltage drop is measured at a pulse width of 8.3ms.
†Measured in a reverse recovery circuit switching from 0.5A forward to 1.0A reverse current recovery to 0.5A.

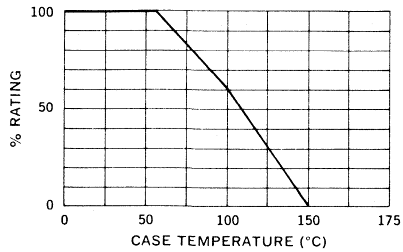
Typical Forward Voltage Per Leg vs. Forward Current

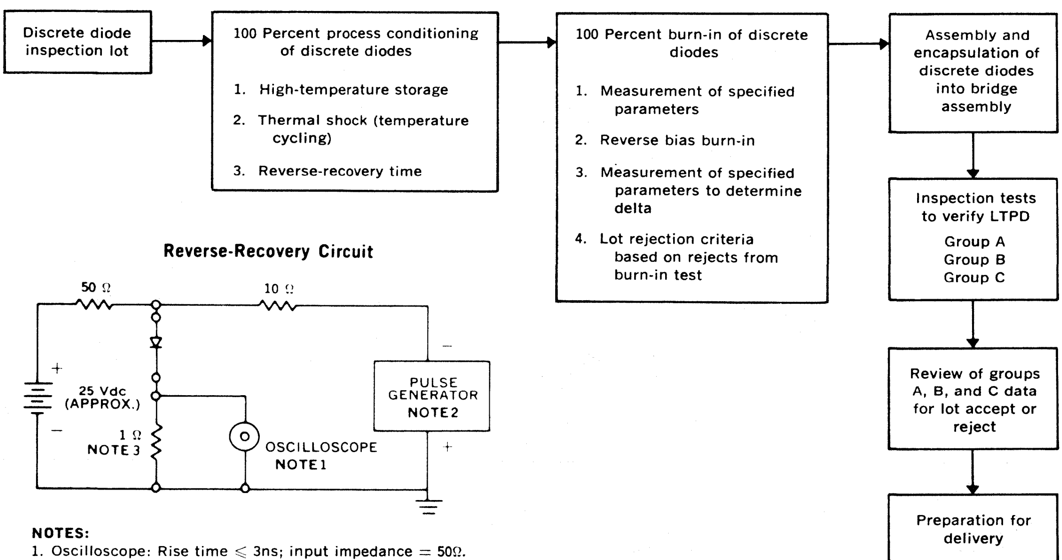


Typical Leakage Current vs. PIV



Current Derating Curve





NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

TRANSIENT VOLTAGE SUPPRESSORS

for Microprocessor and IC Protection Applications

**TVS505-
TVS528**

FEATURES

- 500W for 1mS Pulse Power Capability
- Clamping Time in Picoseconds
- Direct Applicability for all popular Microprocessors and IC families
- Metallurgically bonded assembly system to assure long term reliability
- Miniature glass encased hermetically sealed package

DESCRIPTION

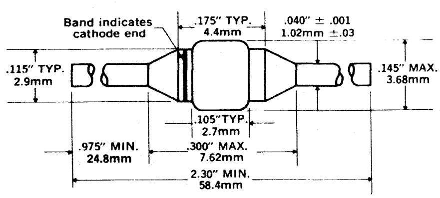
Unitrode's TVS505 series of transient voltage suppressors features oxide passivated zener type chips with full-faced metallurgical bonds on both sides to achieve high surge capability and negligible electrical degradation under repeated surge conditions. The series is especially useful in protecting microprocessor, MOS, CMOS, TTL, Schottky TTL, ECL, I²L and linear integrated circuits from spurious transient disturbances.

ABSOLUTE MAXIMUM RATINGS @ 25°C

Stand-off Voltage, V_R	5.0V to 28.0V
Breakdown Voltage	See Table
Forward Surge Current (8.3 mSec half sinewave)	50A
Peak Pulse Current	See Table
Peak Pulse Power	See Graphs
Power, Continuous	5W
Storage and Operating Temperature	−65°C to +175°C

MECHANICAL SPECIFICATIONS

TVS505 Series



BODY B

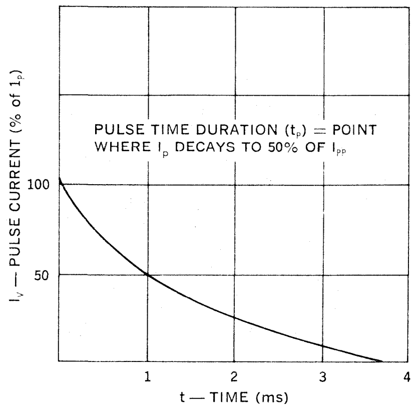
ELECTRICAL SPECIFICATIONS @ 25°C

TVS Part No.	Stand -Off Voltage V_R	Min. Breakdown Voltage $BV_{(min)}$ @ 1mA	Max. Leakage Current I_R @ V_R	Max. Clamping Voltage* V_C @ 1A	Max. Clamping Voltage* V_C @ 5A	Max. Clamping Voltage* V_C @ 10A	Max. Peak Pulse Current* I_{PP}	Max. Clamping Voltage* V_C @ I_{PP}
B Package	Volts	Volts	μA	Volts	Volts		Amps	Volts
TVS 505	5.0	6.0	300	7.4		7.9	53.7	9.3
TVS 510	10.0	11.1	5	13.2		14.4	30.3	16.5
TVS 512	12.0	13.8	5	16.5		18.5	23.8	21.0
TVS 515	15.0	16.7	5	19.7		22.2	19.8	25.2
TVS 518	18.0	20.4	5	23.8	26.0		16.3	30.5
TVS 524	24.0	28.4	5	32.4	37.0		11.9	42.0
TVS 528	28.0	30.7	5	35.9	41.0		10.7	46.5

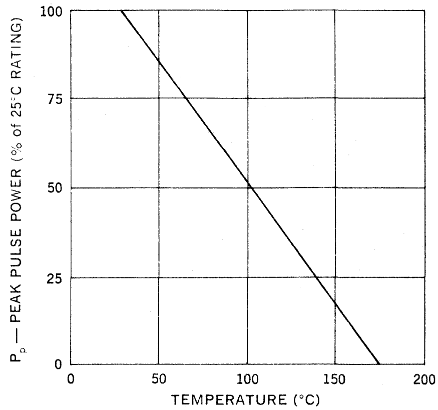
*For 1ms pulse: see Figure 1.

UNITRODE

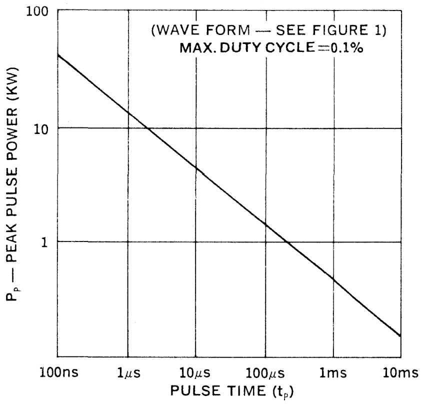
1. Pulse Waveform



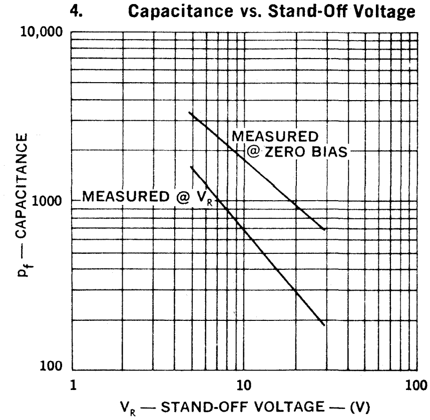
2. Derating Curve



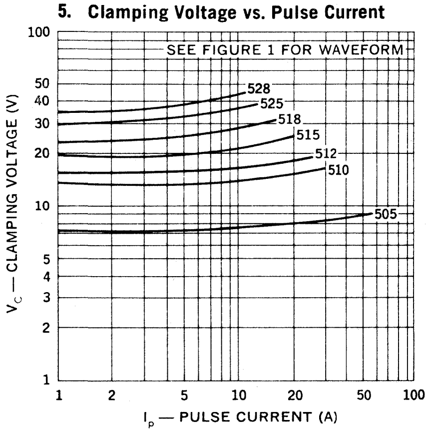
3. Peak Pulse Power vs. Pulse Duration



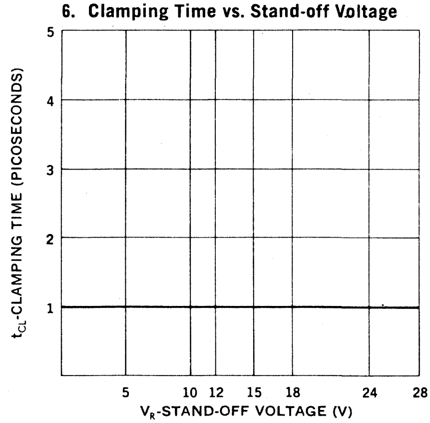
4. Capacitance vs. Stand-Off Voltage



5. Clamping Voltage vs. Pulse Current



6. Clamping Time vs. Stand-off Voltage



APPLICATIONS NOTES

INTRODUCTION

During transient periods, systems voltages and currents are often many times greater than their steady state values and, therefore, must be considered in overall electronic system design in order to ensure required circuit performance and reliability, during both the transient duration and after transient occurrence (steady state).

Transients may result from a variety of causes such as normal switching operations, i.e., power supply turn-on and turn-off cycles, routine AC lines fluctuations due to changing power requirements of heavy industrial equipment or abrupt circuit disturbances such as faults, voltage dips, magnetic coupling by electro-mechanical devices, and lightning surges. With the increasing usage of microprocessors and associated integrated circuits (RAMs, ROMs, pROMs, I/O devices) the question of transient voltage protection must be considered by circuit and system designers. Voltage transients are a major cause of component failure in semiconductor circuit applications. Random high voltage transient spikes can permanently damage these voltages-sensitive devices or disrupt proper system operation. Catastrophic power supply conditions are not necessarily what should concern the designer most — just normal power supply on-off cycles have the potential of emitting spikes of sufficient energy content to blow out an entire device chain. Surviving devices are then suspect and may be only marginally effective or show degraded performance. Troubleshooting, isolating and replacing damaged devices is obviously time consuming and very costly, especially when performed in the field.

While most microprocessor and IC semiconductor manufacturers design some form of diode-resistive input clamping network on the chip itself, transient voltage protection offered is very minimal — on the order of several watts. Manufacturers are also reticent in making device performance and reliability claims when power supply operation extends beyond the maximum rated level of the individual device family for even relatively short durations such as those that may be encountered during on-off transitions. The need for some protective device to suppress voltage transient is, therefore, indicated.

Unitrode's TVS 505 series of transient voltage suppressors offers the designer significant price-performance advantages over competing protection methods. Their miniature size permits simple installation on "close-in" or distributed system protection applications such as in the case where circuit boards are dispersed throughout an electronic rack or large enclosure. Dispersed usage aids in system troubleshooting and also affords extended transient voltage protection coverage where the likelihood exists for internal system disturbances, such as those caused by relay or coil driven mechanisms, where large current transients can be induced to adjacent logic circuitry.

In spite of its small size, the TVS 505 suppressor series is capable of dissipating 500 watts peak pulse power for a 1 millisecond duration. Response time to transients is near instantaneous — about 1×10^{-12} seconds. The series also exhibits both low and repeatable clamping factors throughout the performance range.

TRANSIENT VOLTAGE SUPPRESSOR CHARACTERISTICS

Unitrode's TVS 505 series has been devised to allow for ease of selection as a system element. It is instructive to outline salient device specification parameters.

STAND-OFF VOLTAGE

The proper device is selected in conjunction with the nominal power supply voltage level of the application. For example, to suppress transient voltages from a 5-volt logic power supply, a device with a stand-off voltage, V_R, of 5 volts is chosen. Stand-off voltages other than those indicated in the specification table can be provided.

MAXIMUM LEAKAGE CURRENT

Maximum Leakage Current, I_R, is measured at V_R to indicate maximum expected current drain by the TVS element. While often much lower in actuality than indicated in the specification table, leakage current selection can be performed at the factory to assure lower leakage current for critical applications.

MINIMUM BREAKDOWN VOLTAGE

The minimum device breakdown voltage, designated by BV (min), corresponds to the point at which voltage clamping is initiated and incorporates application design factors relating to user power supply regulation tolerances as well as system operating temperature considerations. This parameter is measured at a test current of 1 mA.

MAXIMUM CLAMPING VOLTAGE

Maximum Clamping Voltage, V_C, represents the maximum peak voltage appearing across the device when subjected to a surge current for a 1 millisecond time duration. Clamping voltage is normally specified at maximum rated peak pulse current for the specific device, but is also provided at intermediate pulse current levels. The peak pulse current is defined as an exponential waveform. See Figure (1).

TYPICAL APPLICATIONS

The TVS 505 series of transient voltage suppressors has been developed primarily to serve the need to provide adequate suppression of unwanted electrical disturbances which, if unchecked, have the potential of damaging microprocessor and related integrated circuit components. While standard available voltage levels cover most all popular microprocessors and digital integrated circuit families, voltages levels other than those indicated can be provided to meet specific user requirements. Several examples of common usage follow:

MICROPROCESSOR AND IC DEVICE PROTECTION

When configured across DC power supply lines, the TVS 505 series offers supply voltage transient suppression for:

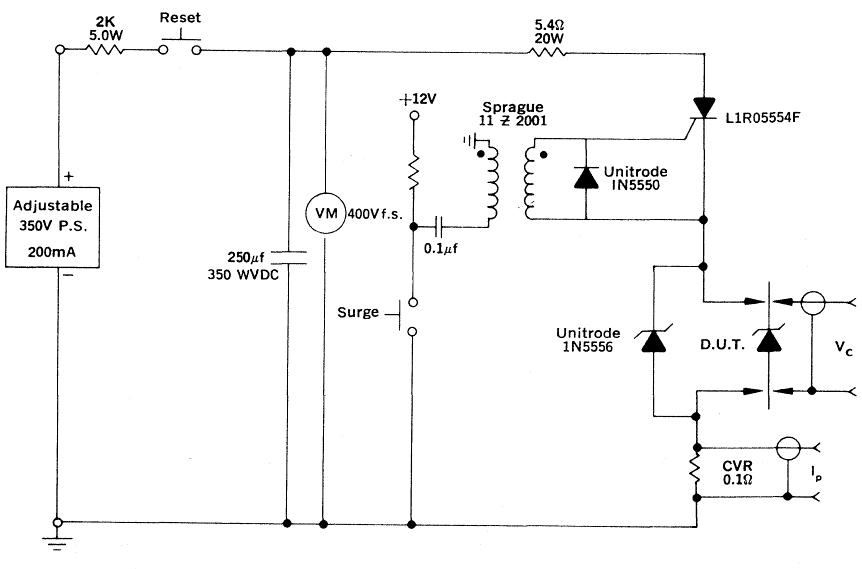
- MOS, CMOS, and Bipolar Microprocessors.
- MOS and Bipolar Memories, (RAMs, ROMs, pROMs), I/O and clock devices.
- MOS, CMOS, TTL, Schottky TTL, ECL, I^2L and custom MOS/LSI integrated circuits employed in critical applications under potentially damaging electrical environments.

Due to its minature size and near instantaneous response time to transients, the TVS 505 series can also provide efficient system protection through installation across data, address, or control signal lines in digital control applications where factory floor equipment installations pose unique transient suppression problems.

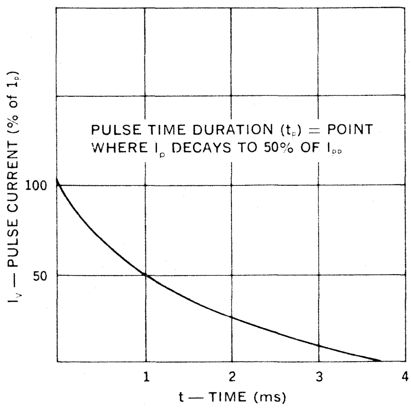
POWER TRANSISTOR DRIVER PROTECTION

Transistors used as output drivers for primarily inductive loads such as relay coils, solenoids, and motor controls require protection against transient voltages, (which often will exceed their breakdown voltage) generated on the collector when such loads are switched. The TVS 524 or TVS 528 can serve to clamp these transient voltages to levels consistent with proper system operation.

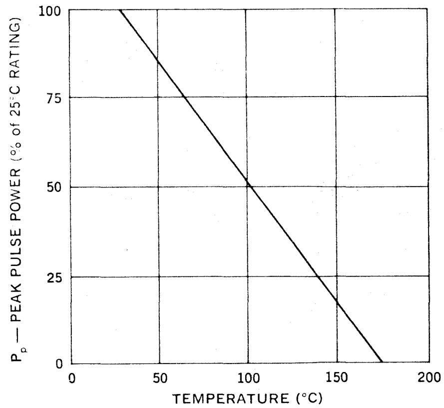
Suggested Set-up for Surge Testing



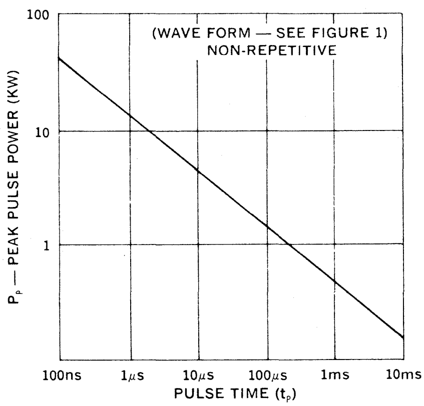
1. **Pulse Waveform**



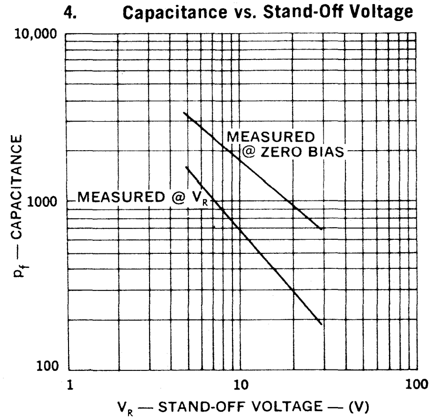
2. **Derating Curve**



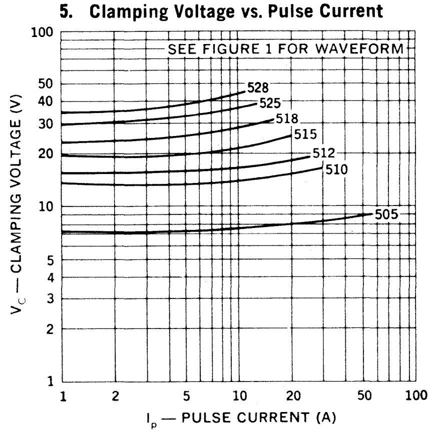
3. **Peak Pulse Power vs. Pulse Duration**



4. **Capacitance vs. Stand-Off Voltage**



5. **Clamping Voltage vs. Pulse Current**



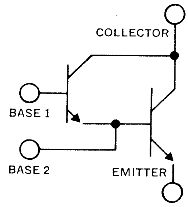
POWER DARLINGTONS

10 Amp, 150V, Planar NPN

U2T101
U2T105
U2T201
U2T205

FEATURES

- High Current Gain: up to 2000 min @ $I_C = 5A$
- Low Saturation Voltage: as low as 1.5V max @ $I_C = 5A$
- High Voltage: up to 150V min V_{CER}
- Monolithic Design Incorporating Multiple-Emitter Techniques
- Triple-Diffused Planar Construction



DESCRIPTION

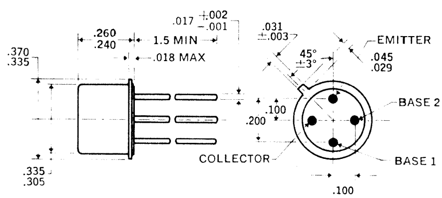
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33 U2T101	TO-33 U2T105	3 PIN TO-66 U2T201	3 PIN TO-66 U2T205
Collector-Emitter Voltage	80V	150V	80V	150V
Emitter Base Voltages,				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2.5W	2.5W
100°C Case	5W	5W	25W	25W
Thermal Resistance, Junction to Case	20°C/W		4°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

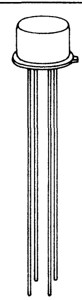
U2T101 U2T105



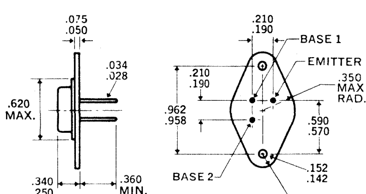
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO33



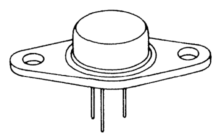
U2T201 U2T205



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-66



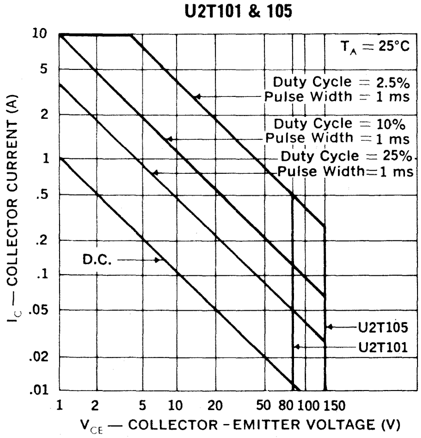
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

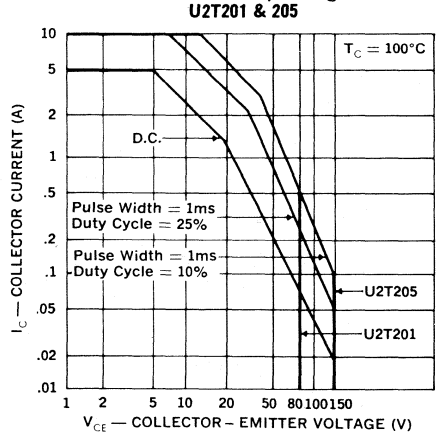
Test	Symbol	U2T101 & U2T201 Min.	U2T101 & U2T201 Max.	U2T105 & U2T205 Min.	U2T105 & U2T205 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = 1.0A$, $V_{CE} = 2V$, $R_{B2E} = 1K$
D.C. Current Gain (Note 1)	h_{FE}	2000	—	1000	—	—	$I_C = 5A$, $V_{CE} = 5V$, $R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	2.5	V	$I_C = 5A$, $R_{B2E} = 100$ U2T101, 201: $I_{B1} = 5mA$ U2T105, 205: $I_{B1} = 10mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}	80	—	150	—	V	$I_C = 25mA$, $R_{B1E} = 2.2K$, $R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	μA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$ U2T101, 201: $V_{CE} = 80V$ U2T105, 205: $V_{CE} = 150V$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$, $T = 150°C$ U2T101, 201: $V_{CE} = 80V$ U2T105, 205: $V_{CE} = 150V$
Collector Capacitance	C_{obo}	—	100	—	100	pf	$V_{CB1} = 10$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = 1.0A$, $V_{CE} = 10V$, $f = 10MHz$, $R_{B2E} = 100$
Switching Speeds: Delay Time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = 30V$, $I_C = 5A$, U2T101, 201: I_B (on) $= I_B$ (off) $= 5mA$, U2T105, 205: I_B (on) $= I_B$ (off) $= 10mA$, $R_{B2E} = 100$
Switching Speeds: Rise Time	t_r	300 Typ.		400 Typ.		ns	
Switching Speeds: Storage Time	t_s	600 Typ.		500 Typ.		ns	
Switching Speeds: Fall Time	t_f	500 Typ.		500 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

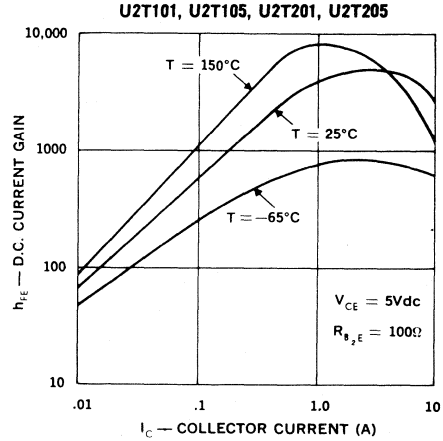
Maximum Safe Operating Area
U2T101 & 105



Maximum Safe Operating Area
U2T201 & 205



D.C. Current Gain vs. Collector Current
U2T101, U2T105, U2T201, U2T205



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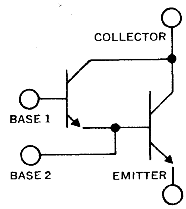
POWER DARLINGTONS

U2T301 U2T401
U2T305 U2T405

5 Amp, 150V, Planar NPN

FEATURES

- High Current Gain: 1000 min. @ $I_C = 2A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- High Voltage: up to 150V min. V_{CER}
- Monolithic Design Incorporating Multiple-Emitter Techniques
- Triple-Diffused Planar Construction



DESCRIPTION

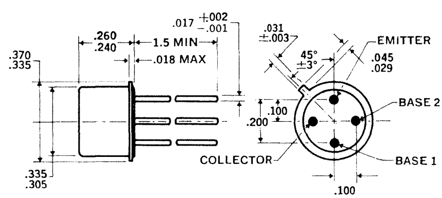
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33 U2T301	TO-33 U2T305	3 PIN TO-66 U2T401	3 PIN TO-66 U2T405
Collector-Emitter Voltage	60V	150V	60V	150V
Emitter Base Voltages,				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	2A	2A	2A	2A
Peak Collector Current	5A	5A	5A	5A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	4W	4W	16W	16W
Thermal Resistance				
Junction to Case	25°C/W		6°C/W	
Operating and Storage Temperature Range	—65°C to 200°C		—65°C to 200°C	

MECHANICAL SPECIFICATIONS

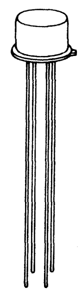
U2T301 U2T305



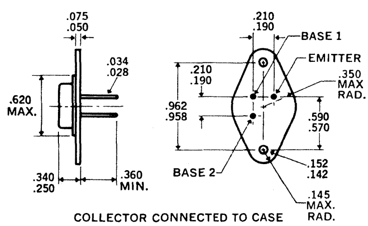
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



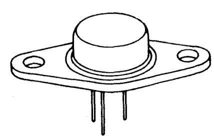
U2T401 U2T405



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 Pin TO-66



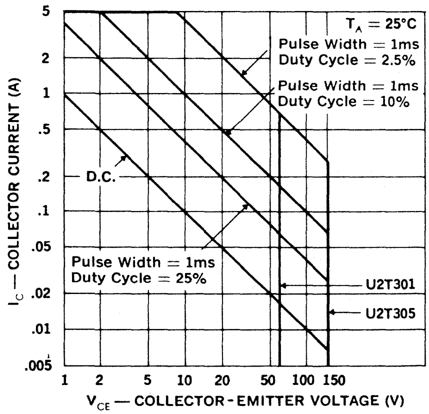
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

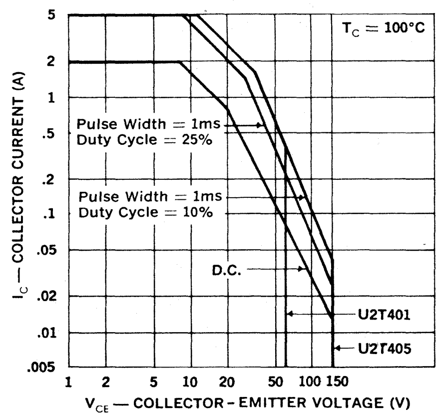
Test	Symbol	U2T301 & U2T401 Min.	U2T301 & U2T401 Max.	U2T305 & U2T405 Min.	U2T305 & U2T405 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 1A$, $V_{CE} = 2V$, $R_{B2E} = 1K$
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 2A$, $V_{CE} = 5V$, $R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	2.5	V	$I_C = 2A$, $R_{B2E} = 100$, $I_{B1} = 4mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}	60	—	150	—	V	$I_C = 25mA$, $R_{B1E} = 2.2K$, $R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	µA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector Cutoff Current	I_{CER}	—	1.0	—	1.0	mA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$, $T = 150°C$ U2T301, 401: $V_{CE} = 60V$ U2T305, 405: $V_{CE} = 150V$
Collector Capacitance	C_{obo}	—	60	—	60	pf	$V_{CB1} = 10V$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	5	—	5	—	—	$I_C = 0.5A$, $V_{CE} = 10V$, $f = 10MHz$, $R_{B2E} = 100$
Switching Speeds: Delay Time	t_d	100 Typ.		100 Typ.		ns	$V_{CC} = 30V$, $I_C = 2A$, I_B (on) $= I_B$ (off) $= 4mA$
Rise Time	t_r	200 Typ.		300 Typ.		ns	
Storage Time	t_s	800 Typ.		800 Typ.		ns	
Fall Time	t_f	300 Typ.		300 Typ.		ns	$R_{B2E} = 100$

Note: 1. Pulse width = 300 µs; duty cycle ≤2%.

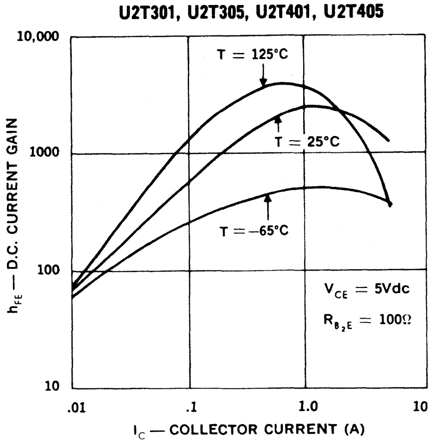
Maximum Safe Operating Area U2T301 & 305



Maximum Safe Operating Area U2T401 & 405



D.C. Current Gain vs. Collector Current U2T301, U2T305, U2T401, U2T405



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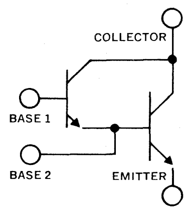
POWER DARLINGTONS

2 Amp, 300V, Planar NPN

U2T712
U2T713
U2T722
U2T723

FEATURES

- High Current Gain: up to 1000 min. @ $I_C = 1A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 2A$
- High Voltage: up to 300V. min. V_{CEO}
- Peak Current: to 5A
- Monolithic Planar Chip Construction



DESCRIPTION

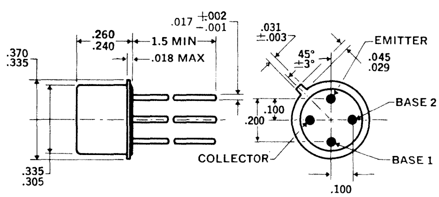
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	TO-33 U2T712	TO-33 U2T713	3 PIN TO-66 U2T722	3 PIN TO-66 U2T723
Collector — Emitter Voltage	200V	300V	200V	300V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	2A	2A	2A	2A
Peak Collector Current	5A	5A	5A	5A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	1W	1W	2W	2W
100°C Case	5W	5W	20W	20W
Thermal Resistance				
Junction-to-Case	20°C/W		5°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

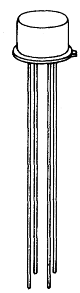
U2T712 U2T713



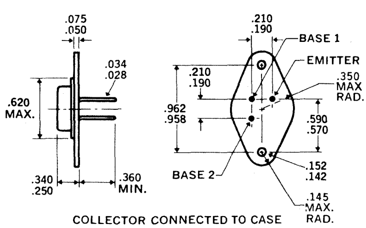
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

TO-33



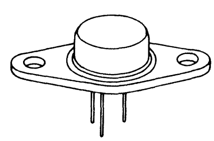
U2T722 U2T723



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66



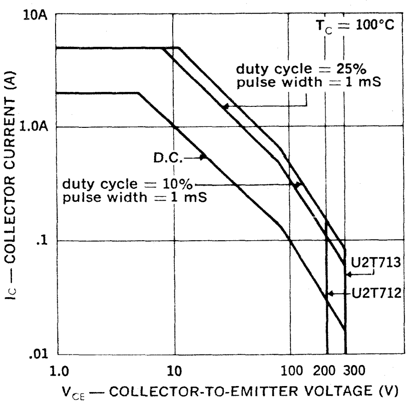
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

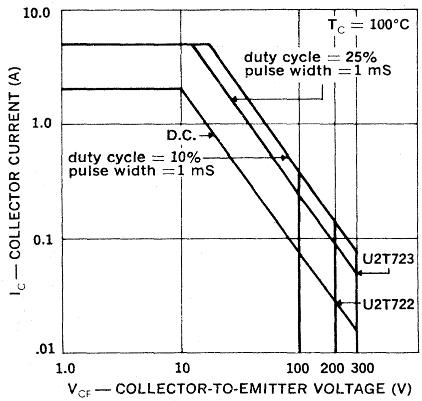
Test	Symbol	U2T712 & 722 Min.	U2T712 & 722 Max.	U2T713 & 723 Min.	U2T713 & 723 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 1A$, $V_{CE} = 5V$, $R_{B2E} = 1K$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	—	1.5	V	$I_C = 2A$, $R_{B2E} = 100$, $I_{B1} = 20mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}	200	—	300	—	V	$I_C = 10mA$
	BV_{CER}	250 Typ.	—	350 Typ.	—	V	$I_C = 10mA$, $R_{B1E} = 2.2K$, $R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	10.0	—	10.0	μA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$ U2T712 & 722: $V_{CE} = 200$ U2T713 & 723: $V_{CE} = 300$
Collector Capacitance	C_{obo}	—	100	—	100	pf	$V_{CBI} = 10V$, $I_E = 0$, f = 1mHz
A.C. Current Gain	h_{fe}	4.0 Typ.	—	4.0 Typ.	—	—	$I_C = 0.5A$, $V_{CE} = 10V$, f = 20mHz, $R_{B2E} = 100$
Rise Time Storage Time Fall Time	t_r t_s t_f	0.6 Typ. 1.5 Typ. 1.0 Typ.		0.6 Typ. 1.5 Typ. 1.0 Typ.		μS μS μS	$V_{CC} = 100V$, I_B (on) $= I_B$ (off) $= 25mA$, $I_C = 2A$, $R_{B2E} = 100$

Note 1. Pulse width = 300 μS; duty cycle ⩽ 2%

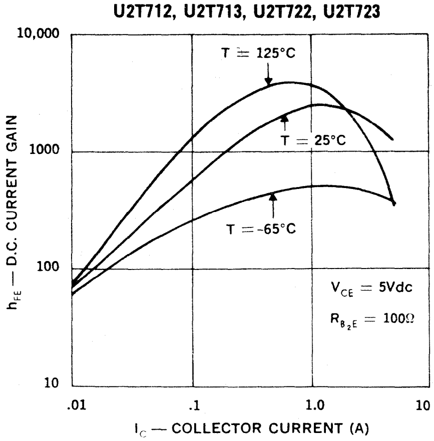
Maximum Safe Operating Area
U2T712 & 713



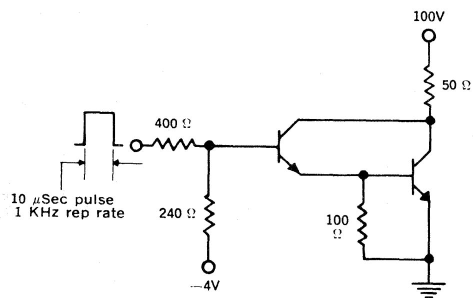
Maximum Safe Operating Area
U2T722 & 723



D.C. Current Gain vs. Collector Current
U2T712, U2T713, U2T722, U2T723



Switching Speed Circuit



$I_C = 2A$, $I_{B1} = -I_{B2} = 25mA$

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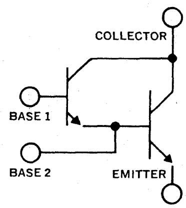
POWER DARLINGTONS

5 Amp, 300 V, Planar NPN

U2T822
U2T823
U2T832
U2T833

FEATURES

- High Current Gain: up to 1000 min. @ $I_C = 3A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 5A$
- High Voltage: up to 300V. min. V_{CEO}
- Peak Current: to 10A
- Monolithic Planar Chip Construction



DESCRIPTION

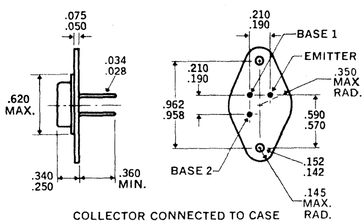
Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip.

ABSOLUTE MAXIMUM RATINGS

	3 PIN TO-66 U2T822	3 PIN TO-66 U2T823	3 PIN TO-3 U2T832	3 PIN TO-3 U2T833
Collector — Emitter Voltage	200V	300V	200V	300V
Emitter — Base Voltages				
V_{EB2}	6V	6V	6V	6V
V_{EB1}	12V	12V	12V	12V
D.C. Collector Current	5A	5A	5A	5A
Peak Collector Current	10A	10A	10A	10A
Base 1 Current	0.5A	0.5A	0.5A	0.5A
Power Dissipation				
25°C Ambient	2.5W	2.5W	3.5W	3.5W
100°C Case	35W	35W	60W	60W
Thermal Resistance				
Junction-to-Case	2.9°C/W		1.7°C/W	
Operating and Storage Temperature Range	−65°C to 200°C		−65°C to 200°C	

MECHANICAL SPECIFICATIONS

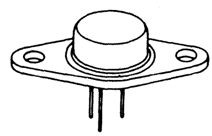
U2T822 & 823



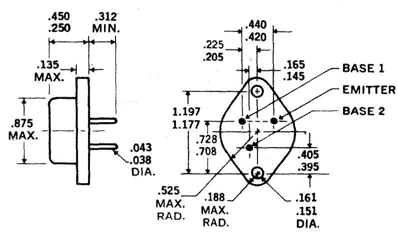
COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-66



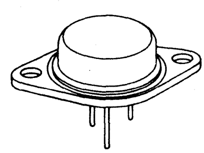
U2T832 & 833



COLLECTOR CONNECTED TO CASE

Dimensions in inches.

3 PIN TO-3



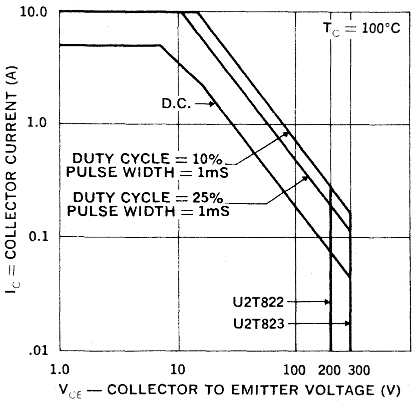
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

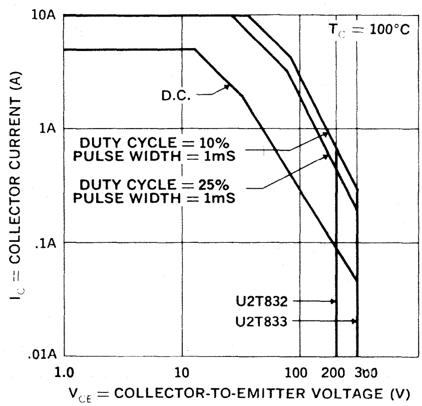
Test	Symbol	U2T822 & 832 Min.	U2T822 & 832 Max.	U2T823 & 833 Min.	U2T823 & 833 Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	1000	—	—	$I_C = 3A$, $V_{CE} = 5V$, $R_{B2E} = 100$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	1.5	—	1.5	V	$I_C = 5A$, $R_{B2E} = 100$, $I_{B1} = 50mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO} BV_{CER}	200 250 Typ.	— —	300 350 Typ.	— —	V V	$I_C = 10mA$ $I_C = 10mA$, $R_{B1E} = 22K$, $R_{B2E} = 100$
Collector Cutoff Current	I_{CER}	—	10	—	10	μA	$R_{B1E} = 2.2K$, $R_{B2E} = 100$ U2T 822 & 832 : $V_{CE} = 200V$ U2T 823 & 833 : $V_{CE} = 300V$
Collector Capacitance	C_{obo}	—	200	—	200	pf	$V_{CB1} = 10V$, $I_E = 0$, f = 1mHz
A.C. Current Gain	h_{fe}	4.0 Typ.	—	4 Typ.		—	$I_C = 5A$, $V_{CE} = 10V$, f = 20mHz, $R_{B2E} = 100$
Rise Time Storage Time Fall Time	t_r t_s t_f	0.6 Typ. 2.0 Typ. 1.0 Typ.		0.6 Typ. 2.0 Typ. 1.0 Typ.		μs μs μs	$V_{CC} = 100V$, $I_C = 5A$, I_B (on) = I_B (off) = 50mA, $R_{B2E} = 100$

Note 1: Pulse width = 300 μS; duty cycle $\leqslant$ 2%.

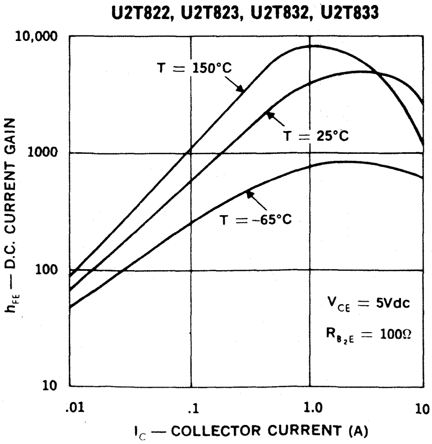
Maximum Safe Operating Area
U2T822 & 823



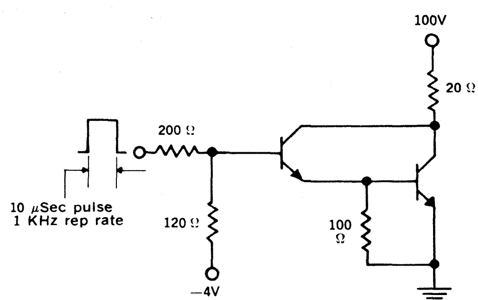
Maximum Safe Operating Area
U2T832 & 833



D.C. Current Gain vs. Collector Current
U2T822, U2T823, U2T832, U2T833



Switching Speed Circuit



I_C = 5A, I_{B1} = $-I_{B2}$ = 50mA

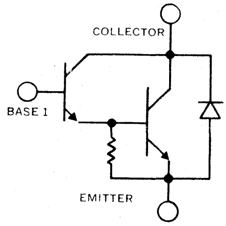
POWER DARLINGTONS

3 Amp, 100V, Planar NPN, Plastic

U2TA506
U2TA508
U2TA510

FEATURES

- High Current Gain: 500 min. @ $I_C = 3A$
- Low Saturation Voltage: as low as 1.5V max. @ $I_C = 3A$
- Economic Plastic Molded Construction



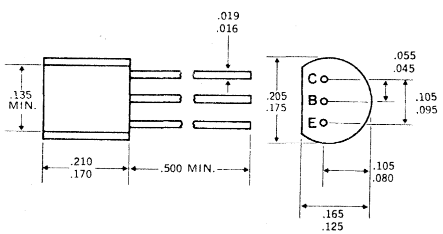
DESCRIPTION

Unitrode NPN Darlingtons consist of a two transistor circuit on a single monolithic planar chip, including integral bias resistance and protective diode. It is ideally suited for pulse power applications in power supplies, printers, solid state relays and displays.

ABSOLUTE MAXIMUM RATINGS

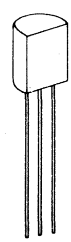
	U2TA506	TO-92 U2TA508	U2TA510
Collector-Base Voltage, V_{CBO}	80V	100V	100V
Collector-Emitter Voltage, V_{CEO}	60V	80V	120V
Emitter-Base Voltage, V_{EBO}		5V	
D.C. Collector Current, I_C		.75A	
Peak Collector Current, I_C		5A	
Base Current, I_B		.6A	
Power Dissipation			
25°C Case		2.4W	
25°C Ambient		970mW	
Thermal Resistance, Θ_{J-C}		62.5°C/W	
Thermal Resistance, Θ_{J-A}		155°C/W	
Storage Temperature Range		−55 to +150°C	
Maximum Junction Temperature		+175°C	

U2TA506 U2TA508 U2TA510



Dimensions in inches.

TO-92



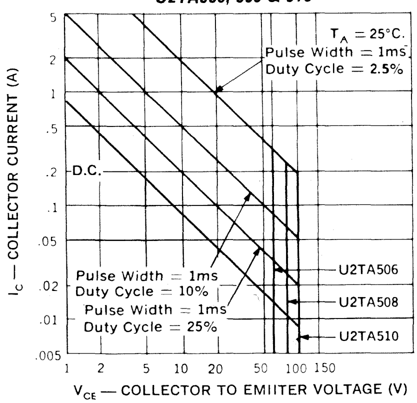
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

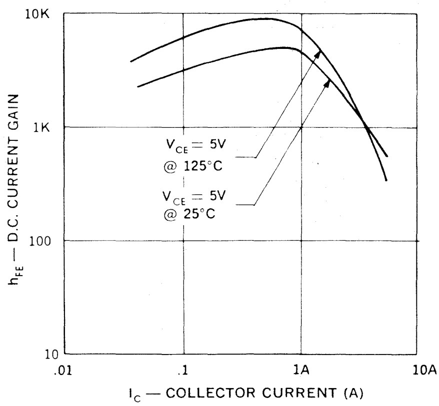
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	1000	—	—	$I_C = 1A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	500	—	—	$I_C = 3A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	300 Typ.		—	$I_C = 5A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	Vdc	$I_C = 3A$, $I_B = 30mA$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
U2TA506		60	—		
U2TA508		80	—		
U2TA510		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rating, $R = 100\Omega$
Collector-Emitter Cutoff Current	I_{CER}	—	1	mAdc	V_{CE} = rating, $R = 100\Omega$, $T = 125°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
A.C. Current Gain	h_{fe}	4.0 Typ.		—	$I_C = 1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Rise Time	t_r	600 Typ.		ns	$I_C = 2A$
Storage Time	t_s	1500 Typ.		ns	$V_{CC} = 100V$, $I_{B(on)} = I_{B(off)} = 4mA$
Fall Time	t_f	800 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤ 2%.

Maximum Safe Operating Area U2TA506, 508 & 510



D.C. Current Gain vs. Collector Current



PUTs

U13T1-U13T4

Planar, TO-18 Hermetic

FEATURES

- Voltage Ratings: to 100V
- Maximum Peak Current: 150nA
- Valley Current: as low as 25 μA
- Low Forward Voltage Drop
- Nano-Amp Leakage
- Hermetically Sealed TO-18 Metal Can

DESCRIPTION

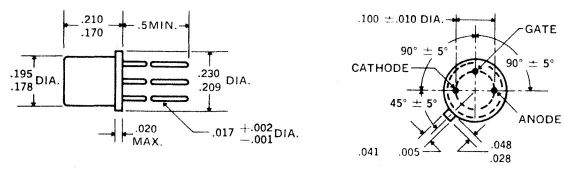
The Unitrode hermetically sealed TO-18 metal can series of programmable unijunction transistors feature blocking voltages to 100V, the highest available to designers. These PUTs are functionally equivalent to standard unijunction transistors, with the added advantages of programming versatility. External resistors can be added to program η, R_{BB}, I_p and I_v, depending upon your design requirements. All units are fully planar passivated. This series features a hermetically sealed TO-18 package for optimum reliability in all environmental conditions. Applications include pulse and timing circuits, SCR trigger circuits, relaxation oscillators, and sensing circuits. For further application information see Unitrode's Application Note U-66.

ABSOLUTE MAXIMUM RATINGS

	U13T1 U13T2	U13T3 U13T4
Anode-to-Cathode Forward Voltage, V_{AK}	40V	100V
Anode-to-Cathode Reverse Voltage, V_{AKR}	40V	100V
Gate-to-Cathode Forward Voltage, V_{GK}	40V	100V
Gate-to-Anode Reverse Voltage, V_{GAR}	40V	100V
Gate-to-Cathode Reverse Voltage, V_{GKR}	5V	5V
Peak Recurrent Forward Current		
10 μs 1% Duty Cycle	8A	8A
100 μs 1% Duty Cycle	5A	5A
Power Dissipation		
25°C Ambient	400mW	400mW
Derating Factor	3.2mW/°C	3.2mW/°C
Storage Temperature Range	−55°C to +150°C	
Operating Temperature Range	−55°C to +150°C	

MECHANICAL SPECIFICATIONS

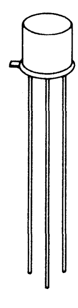
U13T1-U13T4



GATE CONNECTED TO CASE

Dimensions in inches.

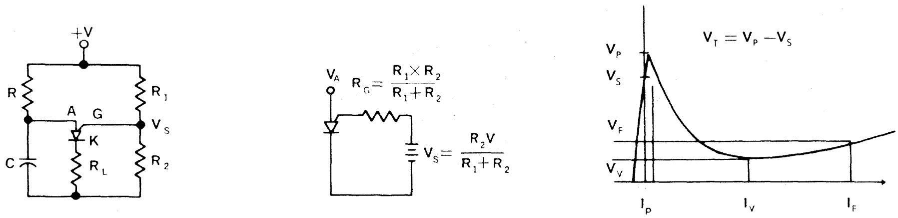
TO-18



UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	Fig.	U13T1, 3 Min.	U13T1, 3 Max.	U13T2, 4 Min.	U13T2, 4 Max.	Units	Test Conditions
Peak Current	I_P	1	—	5	—	1.0	μA	$R_G = 10k, V_s = 10V$
			—	2	—	0.15	μA	$R_G = 1$ Meg.
Valley Current	I_V	1	70	—	25	—	μA	$R_G = 10k, V_s = 10V$
			—	50	—	25	μA	$R_G = 1$ Meg.
Offset Voltage	V_T	1	0.2	0.6	0.2	0.6	V	$R_G = 10k, V_s = 10V$
			0.2	1.6	0.2	0.6	V	$R_G = 1$ Meg.
Gate-to-Anode Leakage	I_{GAO}	2	—	10	—	10	nA	$T = 25°C, V_s =$ rating
			—	100	—	100	nA	$T = 75°C$
Gate-to-Cathode Leakage	I_{GKS}	3	—	100	—	100	nA	$V_s =$ rating
Forward Voltage	V_F	4	—	1.5	—	1.5	V	$I_F = 50mA$
Pulse Output Voltage	V_o	5	6	—	6	—	V	
Pulse Output Rate of Rise	t_r	5	—	80	—	80	ns	



a) Typical Circuit b) Equivalent Test Circuit c) Characteristic Curve

Figure 1

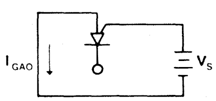


Figure 2

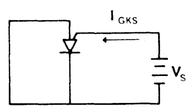


Figure 3

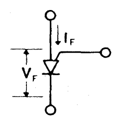


Figure 4

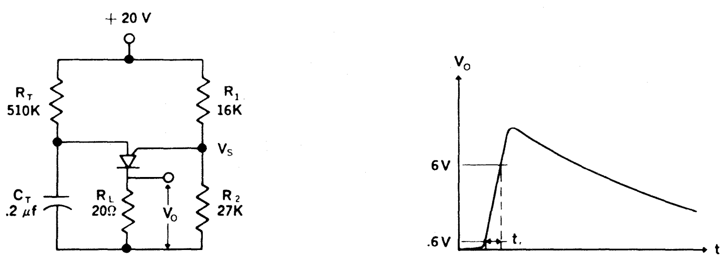


Figure 5

RECTIFIERS, 1 Amp.
Glass

U14A
U14B (1N5059)
U14D (1N5060)
U14F
U14M (1N5061)
U14N (1N5062)
U14P

FEATURES
- 1A @ 100°C
- Up to 1000V
- Glass Passivated Junction
- Hermetic Seal
- Dual Heat Sink

DESCRIPTION
Unitrode Computer Products' glass rectifiers offer a glass passivated junction in a voidless, one-piece, hermetically sealed package. Because of this construction, these devices exhibit maximum heat dissipation under surge and continuous duty and insure long life and stable operation.

ABSOLUTE MAXIMUM RATINGS

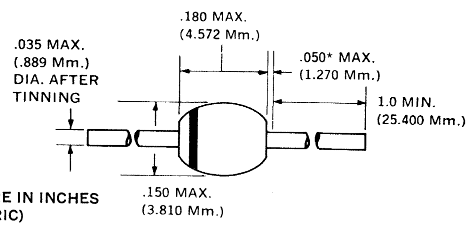
Peak Inverse Voltage	Type
50V	U14F
100V	U14A
200V	U14B (1N5059)
400V	U14D (1N5060)
600V	U14M (1N5061)
800V	U14N (1N5062)
1000V	U14P

Maximum Average D.C. Output Current
@ $T_A = 100°C$ (90°C for 1N5062 & U14P) 1.0A
Non-repetitive Sinusoidal Surge
Full Load Current (8.3ms) 50A
Operating and Storage Temperature Range .... −65 to +175°C

MECHANICAL SPECIFICATIONS

U14 SERIES

Marking band to appear on cathode end.



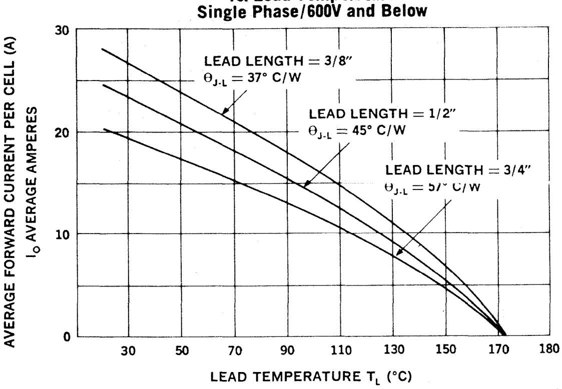
ALL DIMENSIONS ARE IN INCHES AND (METRIC)
*WELD AND SOLDER FLASH NOT CONTROLLED IN THIS AREA

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

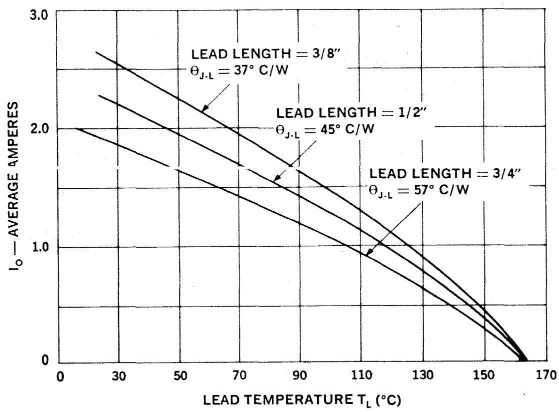
Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Reverse Current @ rated PIV		Maximum Reverse Recovery Time*
			25°C	see below	
U14F	50V	1.1V @ 1A	5μA	300μA	6μS
U14A	100V			300μA	
U14B	200V			300μA @ 175°C	
U14D	400V			300μA @ 175°C	
U14M	600V			200μA @ 175°C	
U14N	800V			200μA @ 165°C	
U14P	1000V			200μA @ 165°C	

*Measured in circuit $I_F = .5A$, $I_R = 1A$, $I_{REC} = .25A$

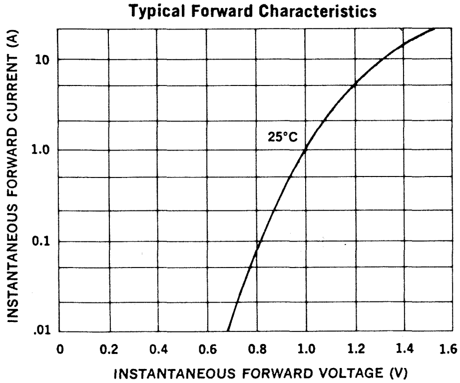
Maximum Current vs. Lead Temperature Single Phase/600V and Below



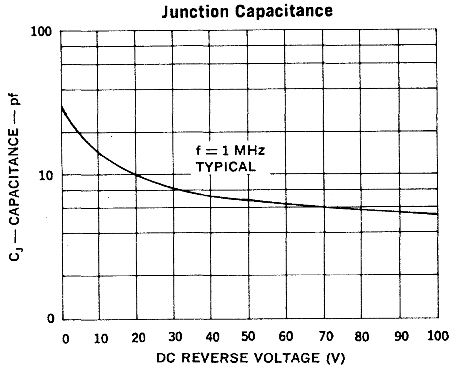
Maximum Current vs. Lead Temperature 800 and 1000V



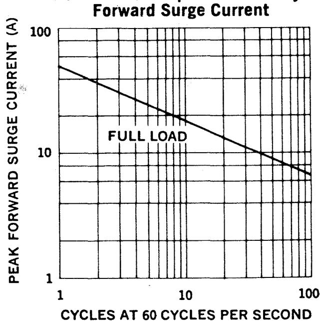
Typical Forward Characteristics



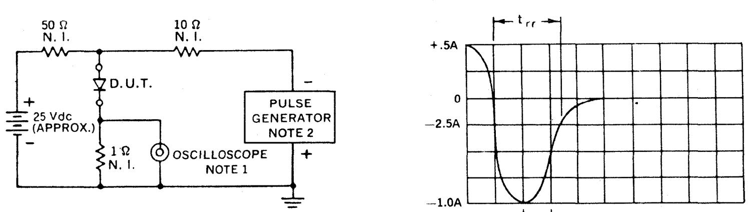
Junction Capacitance



Maximum Non-Repetitive Multicycle Forward Surge Current



Reverse-Recovery Time Characteristic and Test Circuit Diagram



NOTES:
1. Rise time ≤ 7ns max, input impedance = 1 megohm, 22pF.
2. Rise time ≤ 10ns max, source impedance 50Ω.

RECTIFIERS, 3 Amp.
Glass

U15A
U15B (1N5624)
U15D (1N5625)
U15F
U15M (1N5626)
U15N (1N5627)

FEATURES
- 3A @ 70°C
- Up to 800V
- Glass Passivated Junction
- Hermetic Seal
- Dual Heat Sink

DESCRIPTION
Unitrode Computer Products' glass rectifiers offer a glass passivated junction in a voidless, one-piece, hermetically sealed package. Because of this construction, these devices exhibit maximum heat dissipation under surge and continuous duty and insure long life and stable operation.

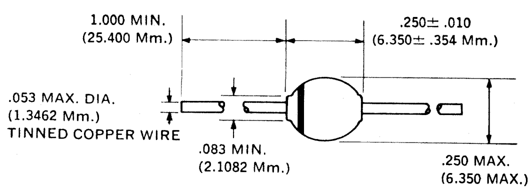
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	U15F
100V	U15A
200V	U15B (1N5624)
400V	U15D (1N5625)
600V	U15M (1N5626)
800V	U15N (1N5627)

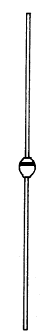
Maximum Average D.C. Output Current
@ $T_A = 70°C$ 3.0A
Non-repetitive Sinusoidal Surge
Full Load Current (8.3ms) 125A
Operating and Storage Temperature .... —65 to 175°C

MECHANICAL SPECIFICATIONS

U15 SERIES



ALL DIMENSIONS ARE IN INCHES AND (METRIC)



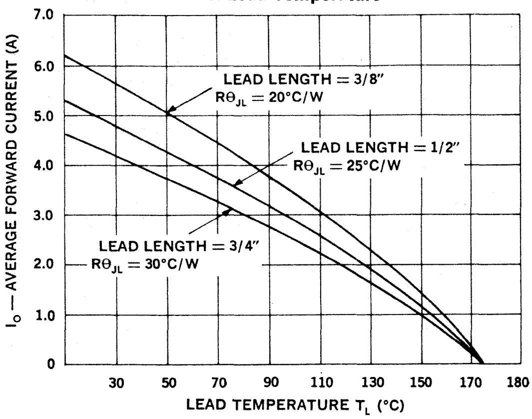
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

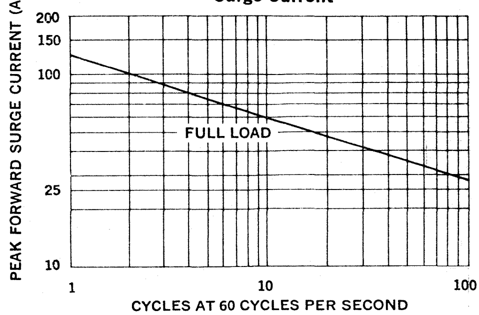
Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Reverse Current @ rated PIV		Maximum Reverse Recovery Time*
			25°C	175°C	
U15F	50V	1.1V @ 3A	5μA	300μA	5μS
U15A	100V			300μA	
U15B	200V			300μA	
U15D	400V			300μA	
U15M	600V			200μA	
U15N	800V			200μA	

*Measured in circuit $I_F = .5A$, $I_R = 1A$, $I_{REC} = .25A$

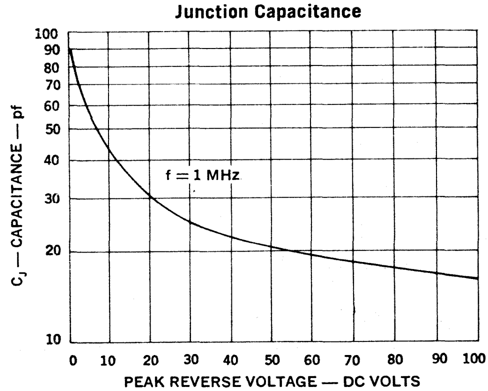
Maximum Current vs. Lead Temperature



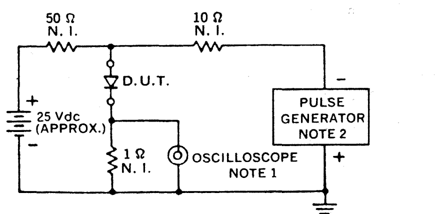
Maximum Non-Repetitive Multicycle Forward Surge Current



Junction Capacitance

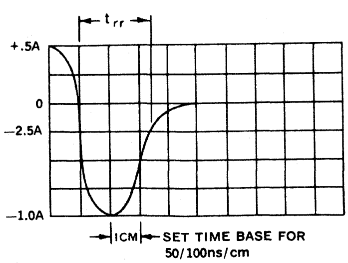


Reverse-Recovery Time Characteristic and Test Circuit Diagram

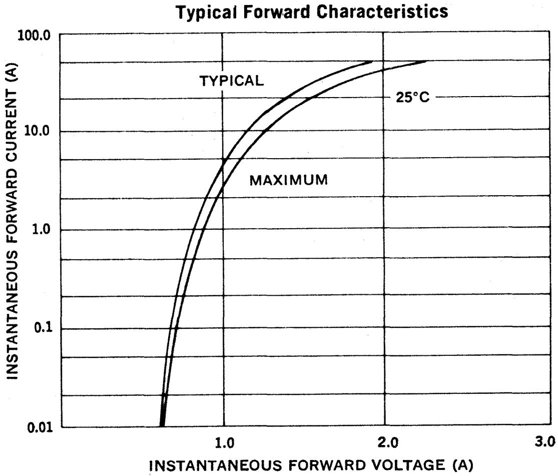


NOTES:

1. Rise time ≤ 7ns max, input impedance = 1 megohm, 22pF.
2. Rise time ≤ 10ns max, source impedance 50Ω.



Typical Forward Characteristics



RECTIFIERS, 1 Amp.
Glass, Fast Recovery

U114A
U114B
U114C
U114D
U114E
U114F
U114M
U114N

FEATURES
- 1A @ 100°C
- Up to 800V
- Glass Passivated Junction
- Hermetic Seal
- Dual Heat Sink

DESCRIPTION
Unitrode Computer Products' glass rectifiers offer a glass passivated junction in a voidless, one-piece, hermetically sealed package. Because of this construction, these devices exhibit maximum heat dissipation under surge and continuous duty and insure long life and stable operation.

ABSOLUTE MAXIMUM RATINGS

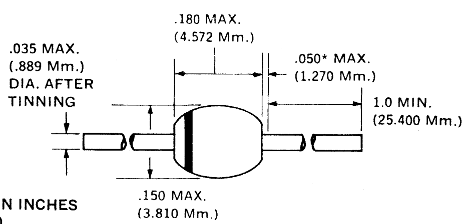
Peak Inverse Voltage	Type
50V	U114F
100V	U114A
200V	U114B
300V	U114C
400V	U114D
500V	U114E
600V	U114M
800V	U114N

Maximum Average D.C. Output Current
@ $T_A = 75°C$ 1.0A
Non-repetitive Sinusoidal Surge
Full Load Current (8.3ms) 40A
Operating Temperature Range .... −65 to +150°C
Storage Temperature Range .... −65 to 175°C

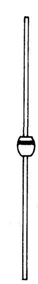
MECHANICAL SPECIFICATIONS

U114 SERIES

Marking band to appear on cathode end.



ALL DIMENSIONS ARE IN INCHES AND (METRIC)
*WELD AND SOLDER FLASH NOT CONTROLLED IN THIS AREA



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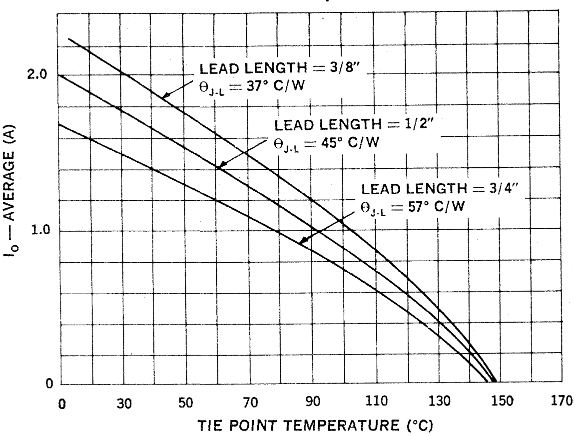
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

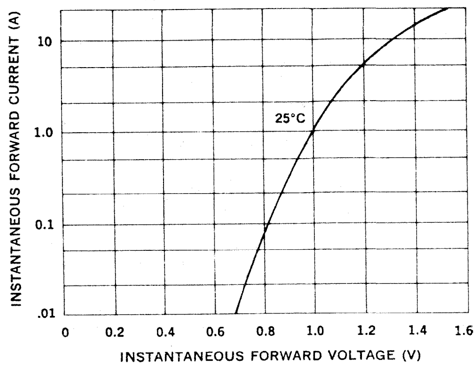
Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Reverse Current @ rated PIV		Maximum Reverse Recovery Time*
			25°C	150°C	
U114F	50V	1.1V @ 1A	5μA	300μA	200ns
U114A	100V			300μA	
U114B	200V			300μA	
U114C	300V			300μA	
U114D	400V			300μA	
U114E	500V			200μA	
U114M	600V			200μA	
U114N	800V			200μA	

*Measured in circuit $I_F = .5A$, $I_R = 1A$, $I_{REC} = .25A$

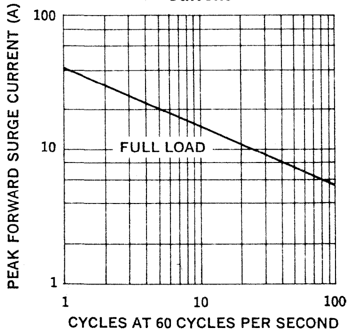
Maximum Current vs. Lead Temperature



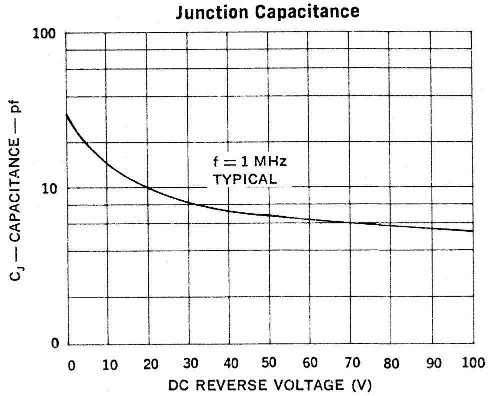
Typical Forward Characteristics



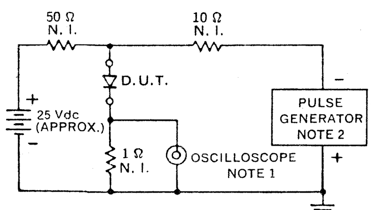
Maximum Non-Repetitive Multicycle Forward Surge Current

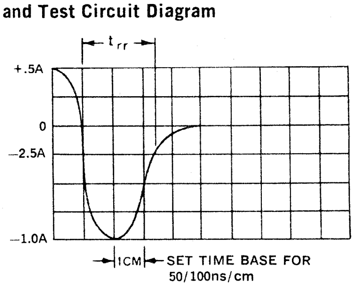


Junction Capacitance



Reverse-Recovery Time Characteristic and Test Circuit Diagram





NOTES:
1. Rise time ⩽ 7ns max, input impedance = 1 megohm, 22pF.
2. Rise time ⩽ 10ns max, source impedance 50Ω.

RECTIFIERS, 3 Amp.
Glass, Fast Recovery

U115A
U115B
U115C
U115D
U115E
U115F
U115M

FEATURES
- 3A @ 55°C
- Up to 800V
- Glass Passivated Junction
- Hermetic Seal
- Dual Heat Sink

DESCRIPTION
Unitrode Computer Products' glass rectifiers offer a glass passivated junction in a voidless, one-piece, hermetically sealed package. Because of this construction, these devices exhibit maximum heat dissipation under surge and continuous duty and insure long life and stable operation.

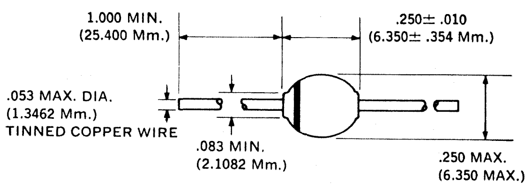
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	U115F
100V	U115A
200V	U115B
300V	U115C
400V	U115D
500V	U115E
600V	U115M

Maximum Average D.C. Output Current @ $T_A = 55°C$ 3.0A
Non-repetitive Sinusoidal Full Load Surge Current (8.3ms) 110A
Operating Temperature Range .... −65 to +150°C
Storage Temperature Range .... −65 to +175°C

MECHANICAL SPECIFICATIONS

U115 SERIES



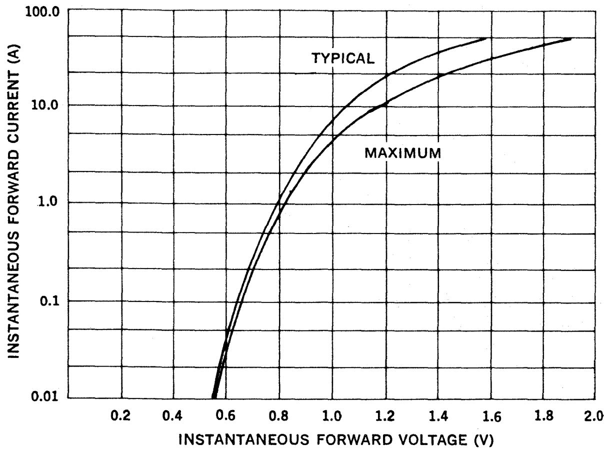
ALL DIMENSIONS ARE IN INCHES AND (METRIC)

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

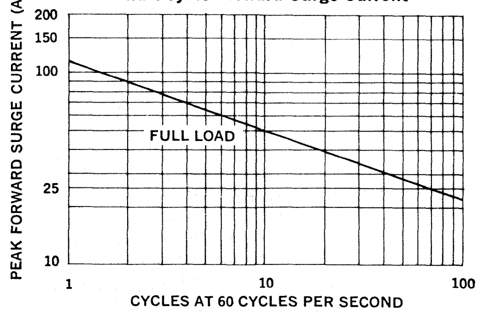
Type	Peak Inverse Voltage	Maximum Forward Voltage	Maximum Reverse Current @ rated PIV 25°C	Maximum Reverse Current @ rated PIV 150°C	Maximum Reverse Recovery Time*
U115F	50V			300μA	
U115A	100V			300μA	
U115B	200V	1.2V		300μA	
U115C	300V	@	5μA	300μA	200ns
U115D	400V	3A		300μA	
U115E	500V			200μA	
U115M	600V			200μA	

*Measured in circuit $I_F = .5A$, $I_R = 1A$, $I_{REC} = .25A$

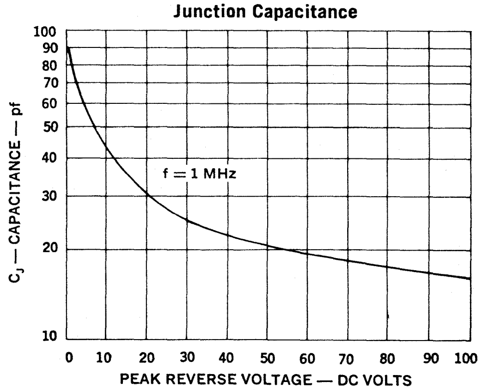
Typical Forward Characteristics



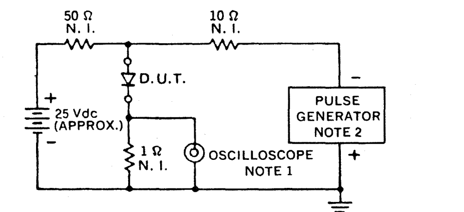
Maximum Non-Repetitive Multicycle Forward Surge Current



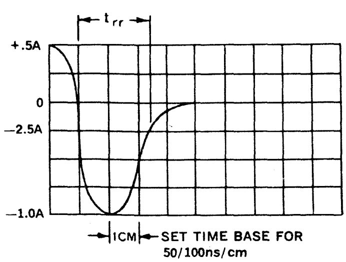
Junction Capacitance



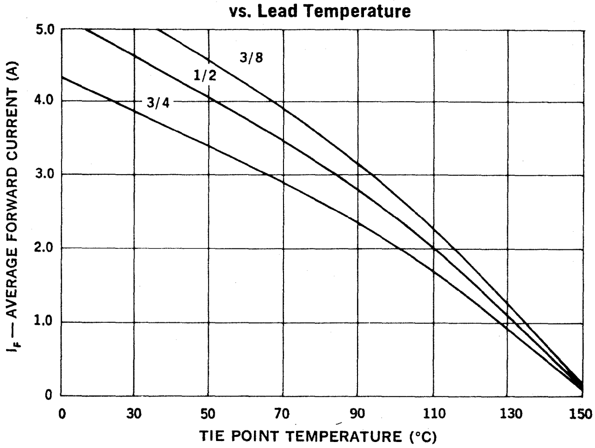
Reverse-Recovery Time Characteristic and Test Circuit Diagram



NOTES:
1. Rise time ⩽ 7ns max, input impedance = 1 megohm, 22pF.
2. Rise time ⩽ 10ns max, source impedance 50Ω.



Maximum Current vs. Lead Temperature



RECTIFIER ASSEMBLIES
High Voltage Doorbell® Modules, Standard and Fast Recovery

UDA, UDB, UDC, UDD, UDE, UDF SERIES

FEATURES
- PIV: from 2.5kV to 15kV
- Stackable to 600kV
- Current Ratings: to 7.7A
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used
- Recovery Time: to 500ns
- Modular Package For Easy Stacking

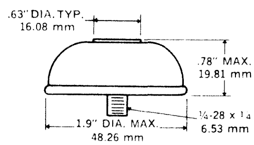
DESCRIPTION
This series of high-voltage, high-current stacks that incorporate a unique modular design makes it ideally suited for high power applications such as in radar systems as charger, hold-off and clipper diodes.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	
UDA, UDC Series	5kV to 15kV
UDB, UDD Series	2.5kV to 7.5kV
UDE, UDF Series	2.5kV to 5kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C

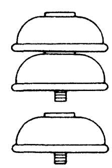
MECHANICAL SPECIFICATIONS

UDA, UDB, UDC, UDD, UDE, UDF SERIES

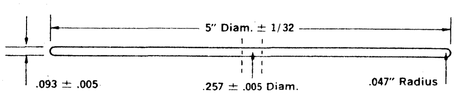


1. **Polarity — Cathode connected to base.**
2. **Part Number — On base of unit.**

Typical Weight — 2.1 ounces 60 grams



EXTENDER PLATE D



Dimensions in inches.

Typical Weight — 2.75 ounces 78 grams

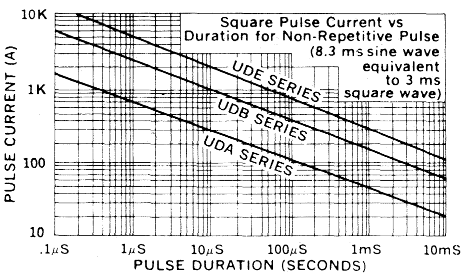
Electrical Specifications (at 25°C unless noted)						Maximum Ratings				
						Maximum Average D.C. Output Current				
Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	Maximum Reverse Recovery Time	$T_C = 75°C$ Air	$T_C = 60°C$ Air with Extender Plate**	$T_C = 50°C$ Oil	Non-Repetitive Sinusoidal Surge (8.3ms) $T_C = 100°C$	Maximum Reverse Transient Energy Absorption
		kV		μA	ns	Amps	Amps	Amps	Amps	joules
Standard	UDE-2.5	2.5	5V @ 3.00A	10		‡ 6.00	7.00	7.70	200	8
Recovery	UDB-2.5	2.5	4V @ 1.50A	5		3.00	3.75	4.25	100	4
	UDE-5	5	10V @ 2.20A	10		‡ 4.50	5.00	5.50	200	14
	UDB-5	5	8V @ 1.00A	5		2.00	2.50	2.75	100	8
	UDA-5	5	8V @ 0.82A	2	—	1.65	2.00	2.20	30	1.5
	UDB-7.5	7.5	12V @ 0.70A	5		1.33	1.65	2.00	100	12
	UDA 7.5	7.5	12V @ 0.60A	2		1.25	1.55	1.75	30	2.5
	UDA-10	10	16V @ 0.50A	2		1.00	1.25	1.40	30	3
	UDA-15	15	25V @ 0.33A	2		0.67	0.80	0.90	30	5
Fast	UDF-2.5	2.5	6V @ 2.20A	10		4.50	5.00	5.30	150	8
Recovery	UDD-2.5	2.5	6V @ 1.20A	5		2.25	2.80	3.30	80	4
	UDF-5	5	11V @ 1.60A	10		3.30	4.00	4.40	150	14
	UDD-5	5	11V @ 0.75A	5		1.50	1.85	2.00	80	8
	UDC-5	5	10V @ 0.70A	2	500*	1.20	1.50	1.70	25	1.5
	UDD-7.5	7.5	17V @ 0.50A	5	350†	1.00	1.25	1.50	80	12
	UDC-7.5	7.5	15V @ 0.50A	2		0.90	1.10	1.25	25	2.5
	UDC-10	10	20V @ 0.37A	2		0.75	0.90	1.00	25	3
	UDC-15	15	30V @ 0.25A	2		0.50	0.60	0.70	25	5

*Measured in a reverse recovery circuit switching from 1.0A forward to 1.0A reverse current recovering to 0.5A.
†Measured in a reverse recovery circuit switching from 0.5A forward to 1.0A reverse current recovering to 0.25A.

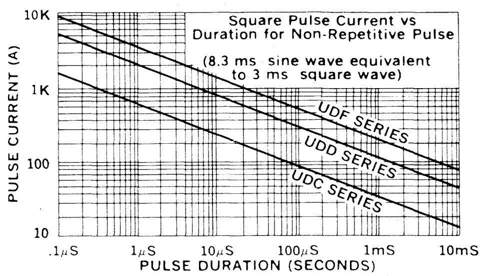
**These ratings are based on using "extender plates" that provide additional surface area to radiate heat. Because of possible corona effects caused by scratches on these plates, extreme care is necessary in their handling and they are not recommended where the working voltage exceeds 7.5KV/module. They should be carefully polished prior to installation.

‡These ratings are based on $T_C = 100°C$.

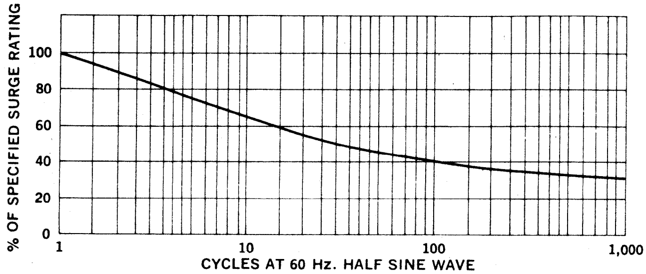
Forward Pulse Current vs. Pulse Duration



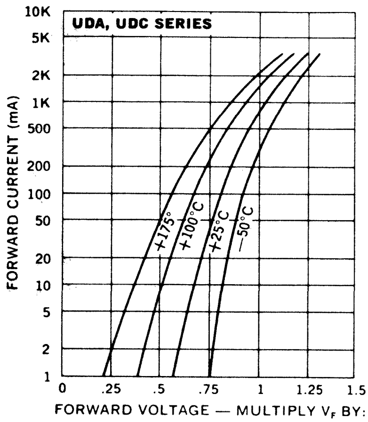
Forward Pulse Current vs. Pulse Duration



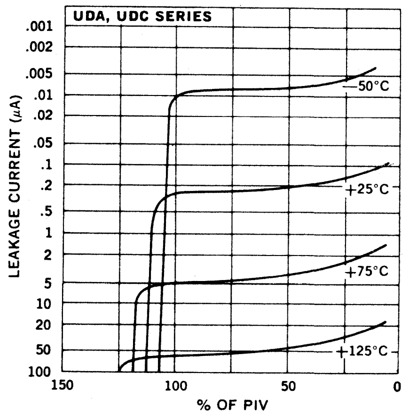
Multiple Surge Rating vs. Duration



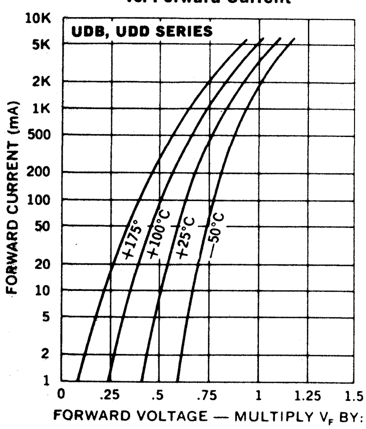
Typical Forward Voltage vs. Forward Current



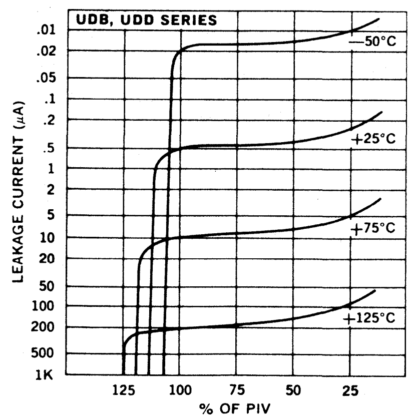
Typical Leakage Current vs. PIV



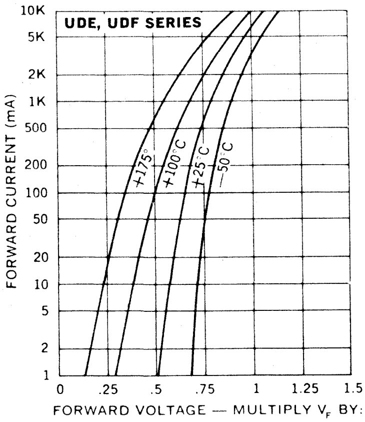
Typical Forward Voltage vs. Forward Current



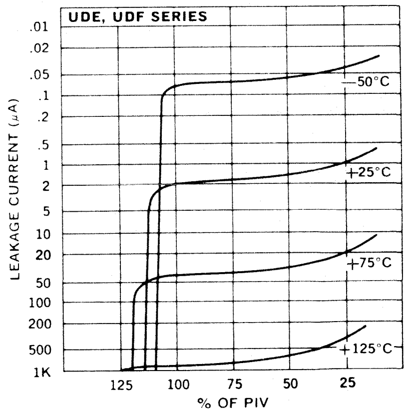
Typical Leakage Current vs. PIV



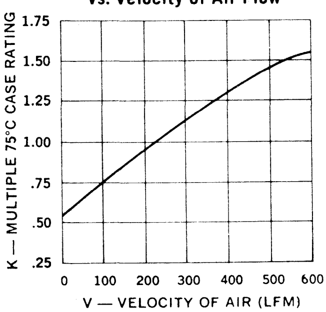
Typical Forward Voltage vs. Forward Current



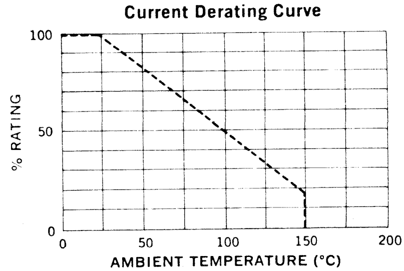
Typical Leakage Current vs. PIV



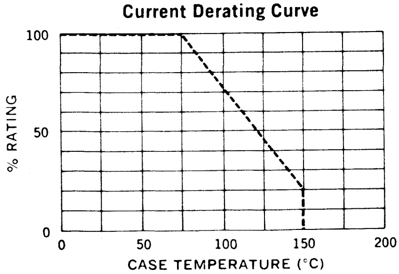
Output Current Ratio vs. Velocity of Air Flow



Current Derating Curve

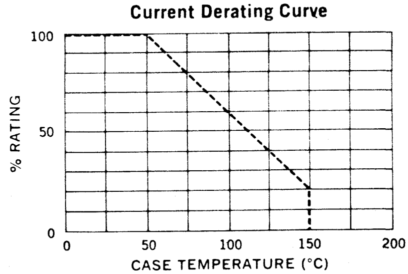


Current Derating Curve



Air Cooled

Current Derating Curve



Oil Immersed

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PRINTED IN U.S.A.

AC POWER ZENERS

1, 3, 5, and 6 Watt Types

UDZ807 SERIES
UDZ5807 SERIES
UDZ7807 SERIES
UDZ8807 SERIES

FEATURES

- Zener Characteristics in Both Directions
- 7.5 to 300V
- High Surge Ratings
- Small Physical Size

DESCRIPTION

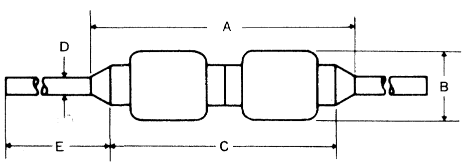
These devices consist of two fused-in-glass zeners brazed anode-to-anode to provide zener action in both directions.

ABSOLUTE MAXIMUM RATINGS

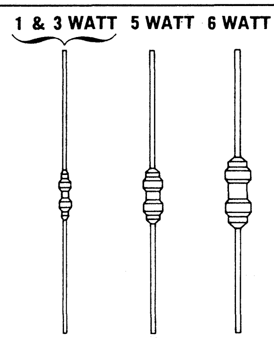
Zener Voltage	7.5 to 300V
Continuous Current	See Tables
Surge Current (8.3ms)	See Tables
Surge Power	See Graph
Power	See Data Sheets for Related Series (UZ8807, UZ807, UZ5807, and UZ7807)
Storage and Operating Temperature	–65°C to +175°C

MECHANICAL SPECIFICATIONS

UDZ807 SERIES UDZ5807 SERIES UDZ7807 SERIES UDZ8807 SERIES



MARKING: "D," followed by last 3 to 4 digits and part number. *Example: 7.5 volt ±10%, 1 watt type would be marked: "D8807".*



Dimensions

1 Watt UDZ8807 Series	3 Watt UDZ807 Series	5 Watt UDZ5807 Series	6 Watt UDZ7807 Series
A. .475″ max.	A. .450″ max.	A. .500″ max.	A. .600″ max.
B. .104″ max.	B. .085″ max.	B. .145″ max.	B. .185″ max.
C. .300″ typical	C. .275″ typical	C. .325″ typical	C. .430″ typical
D. .028″ ± .001″	D. .028″ ± .001″	D. .040″ ± .001″	D. .040″ ± .001″
E. .975″ min.	E. .700″ min.	E. .975″ min.	E. .925″ min.

UNITRODE

Type	Electrical Specifications at 25°C						Maximum Ratings**	
	Nominal Zener Voltage† V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Imped § Z_Z @ I_{ZT}	Maximum Leakage Current	@ Reverse Voltage ±10%	±5%	Maximum Cont. Current I_{ZM}	Maximum Surge Current‡ I_S
±10% Tolerance*	Volts	mA	Ohms	µA	Volts	Volts	mA	Amps
1 WATT ZENERS — Specifications apply for both directions.								
UDZ8807	7.5	34	6	50	4.9	5.2	125	5
UDZ8808	8.2	31	7	30	5.4	5.7	115	4.5
UDZ8809	9.1	28	8	10	5.9	6.2	105	3.9
UDZ8810	10	25	8.5	3	6.6	6.9	95	3.37
UDZ8812	12	23	9	1	8.6	9.1	85	2.25
UDZ8815	15	17	14	0.5	10.8	11.4	63	1.65
UDZ8818	18	14	20	0.5	12.9	13.7	52	1.12
UDZ8820	20	12.5	23	0.5	14.4	15.2	47	1.12
UDZ8824	24	10.5	25	0.5	17.3	18.2	40	0.825
UDZ8827	27	9.5	35	0.5	19.4	20.6	35	0.825
UDZ8830	30	8.5	40	0.5	21.6	22.8	31	0.825
UDZ8833	33	7.5	45	0.5	23.7	25.1	28	0.675
UDZ8836	36	7.0	50	0.5	25.9	27.4	26	0.562
UDZ8840	40	6.5	62	0.5	28.8	30.4	24	0.562
UDZ8845	45	6	75	0.5	32.4	34.2	22	0.450
UDZ8860	60	4	125	0.5	43.2	45.6	15	0.337
3 WATT ZENERS — Specifications apply for both directions.								
UDZ807	7.5	75	3	500	4.9	5.2	400	10
UDZ808	8.2	75	4	300	5.4	5.7	360	8
UDZ809	9.1	75	4	200	5.9	6.2	330	7
UDZ810	10	75	5	100	6.6	6.9	300	5
UDZ812	12	65	5	10	8.6	9.1	250	4
UDZ815	15	50	6	10	10.8	11.4	200	3
UDZ818	18	40	8	5	12.9	13.7	170	2
UDZ820	20	40	9	5	14.4	15.2	150	2
UDZ824	24	30	10	5	17.3	18.2	125	1.5
UDZ827	27	25	12	1	19.4	20.6	110	1.5
UDZ830	30	25	15	1	21.6	22.8	100	1.5
UDZ833	33	20	21	1	23.7	25.1	90	1.2
UDZ836	36	20	21	1	25.9	27.4	85	1
UDZ840	40	20	27	1	28.8	30.4	75	1
UDZ845	45	15	37	1	32.4	34.7	65	0.8
UDZ860	60	10	70	1	43.2	45.6	50	0.6
UDZ210	100	5	175	1	72	76	30	0.4
UDZ222	220	3	325	1	158.4	167.2	15	0.1
UDZ230	300	3	1900	1	216	228	10	0.07

*For ±5% voltage tolerance change the 3rd number from the right from 8 to 7 or from 2 to 1. i.e. UDZ8807 to UDZ8707, UDZ210 to UDZ110, etc.

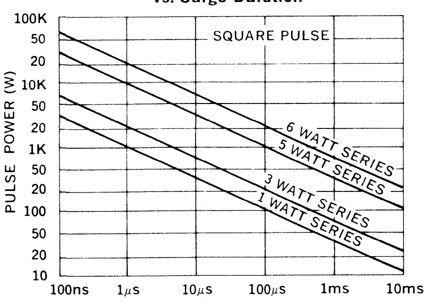
†All zener voltages are measured with an automated test set using a 35ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

**D.C. Ratings are based on the lead temperature conditions shown in the data sheets covering the UDZ8807, UDZ807, UDZ5807, and UDZ7807 series devices. Other conditions will affect the power ratings of all the families except the 1 watt zener family. However, the surge values given apply for any mounting conditions including printed circuit board mounting.

‡Figures shown are for peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

Typical Reverse Surge Power vs. Surge Duration



PULSE DURATION (S)
For Sinusoidal Pulse, Peak Value is 1.4 Times Value Shown

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Type	Electrical Specifications at 25°C						Maximum Ratings**	
	Nominal Zener Voltage† V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Imped § Z_Z @ I_{ZT}	Maximum Leakage Current	@ Reverse Voltage ±10%	±5%	Maximum Cont. Current I_{ZM}	Maximum Surge Current‡ I_S
±10% Tolerance*	Volts	mA	Ohms	μA	Volts	Volts	mA	Amps
5 WATT ZENERS — Specifications apply for both directions.								
UDZ5807	7.5	175	1.8	500	4.9	5.2	620	40
UDZ5808	8.2	150	1.8	400	5.4	5.7	570	32
UDZ5809	9.1	150	2.5	200	5.9	6.2	510	24
UDZ5810	10	125	2.5	100	6.6	6.9	470	22
UDZ5812	12	100	2.5	50	8.6	9.1	385	18
UDZ5815	15	75	3.5	15	10.8	11.4	300	12
UDZ5818	18	65	4	10	12.9	13.7	255	9
UDZ5820	20	65	4.5	10	14.4	15.2	220	8
UDZ5824	24	50	5	10	17.3	18.2	180	6.5
UDZ5827	27	50	6	10	19.4	20.6	155	6
UDZ5830	30	40	8	10	21.6	22.8	140	5.5
UDZ5833	33	40	10	5	23.7	25.1	130	5
UDZ5836	36	30	11	5	25.9	27.4	120	4.5
UDZ5840	40	30	14	5	28.8	30.4	105	4
UDZ5845	45	30	20	5	32.4	34.2	95	3.5
UDZ5860	60	20	40	5	43.2	45.6	75	2.5
UDZ5210	100	10	100	5	72	76	45	1.4
UDZ5222	220	5	550	5	158.4	167.2	20	0.5
UDZ5230	300	5	950	5	216	228	15	0.25
6 WATT ZENERS — Specifications apply for both directions.								
UDZ7807	7.5	325	0.9	1000	4.9	5.2	1250	50
UDZ7808	8.2	300	1.0	800	5.4	5.7	1150	41
UDZ7809	9.1	275	1.2	200	5.9	6.2	1020	31
UDZ7810	10	250	1.2	150	6.6	6.9	950	29
UDZ7812	12	200	1.3	75	8.6	9.1	770	17
UDZ7815	15	150	2.0	30	10.8	11.4	600	17
UDZ7818	18	130	3.5	20	12.9	13.7	500	13
UDZ7820	20	120	4.0	20	14.4	15.2	440	12
UDZ7824	24	100	5.0	20	17.3	18.2	360	10
UDZ7827	27	90	6.0	20	19.4	20.6	310	9
UDZ7830	30	80	8.0	20	21.6	22.8	280	8.5
UDZ7833	33	70	10	10	23.9	25.1	260	7.5
UDZ7836	36	60	12	10	25.9	27.4	240	7
UDZ7840	40	60	15	10	28.8	30.4	210	6.4
UDZ7845	45	50	20	10	32.4	34.2	180	5.5
UDZ7860	60	40	35	10	43.2	45.6	150	3.7
UDZ7210	100	20	90	10	72	76	90	2.3

*For ±5% voltage tolerance change the 3rd number from the right from 8 to 7 or from 2 to 1. i.e. UDZ8807 to UDZ8707, UDZ210 to UDZ110, etc.

†All zener voltages are measured with an automated test set using a 35ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

**D.C. Ratings are based on the lead temperature conditions shown in the data sheets covering the UDZ8807, UDZ807, UDZ5807, and UDZ7807 series devices. Other conditions will affect the power ratings of all the families except the 1 watt zener family. However, the surge values given apply for any mounting conditions including printed circuit board mounting.

‡Figures shown are for peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

RECTIFIERS

High Efficiency, 50 Amp

UES501-UES505

FEATURES

- 50A Continuous Rating at Case Temperature of 125°C
- Exceptional Efficiency
- Low Forward Voltage
- Extremely Fast Reverse Recovery Time
- Extremely Fast Forward Recovery Time
- High Surge
- Radiation Tolerant
- Rugged, High Current Termination

DESCRIPTION:

This series of High Efficiency Power Rectifiers allows circuit designers to design high current, high frequency supplies with very low diode losses. Reverse recovery time is typically 1/10 - 1/100th of equivalent power rectifiers, with even lower forward voltage.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	Type
50V	UES501
75V	UES502
100V	UES503
125V	UES504
150V	UES505

Maximum Average D.C. Output Current @ $T_C = 125°C$ 50A

Non-Repetitive Sinusoidal Surge Current (8.3ms) 600A

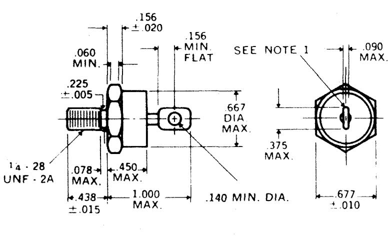
Operating Temperature Range .... −65°C to +175°C

Storage Temperature Range .... −65°C to +175°C

Thermal Resistance .... 1°C/W

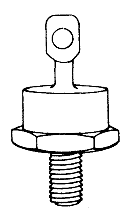
MECHANICAL SPECIFICATIONS

UES501-UES505



Dimensions in inches.

DO-5



Notes:

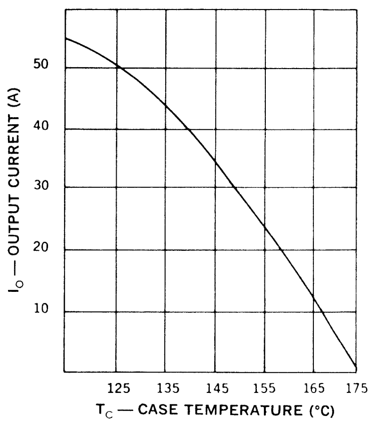
1. Angular orientation of terminal is undefined.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. All dimensions in inches.
5. Polarity is cathode to stud; for anode to stud add suffix "R".

UNITRODE

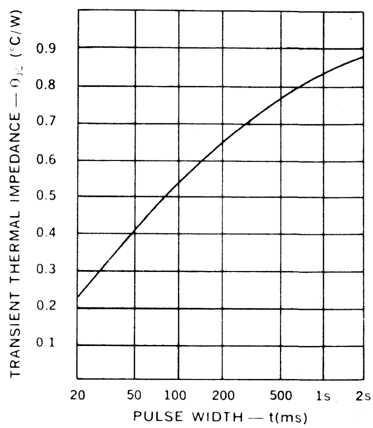
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	Peak Inverse Voltage	Maximum Forward Voltage Drop	Maximum Leakage Current 25°C	Maximum Leakage Current 125°C	Maximum Reverse Recovery Time t_{rr} @ I_F-I_R-I_{REC}
UES501 UES502 UES503 UES504 UES505	50V 75V 100V 125V 150V	.95V @ 50A (pw = 250ms)	25μA	10mA	50ns. 1A-1A-0.5A

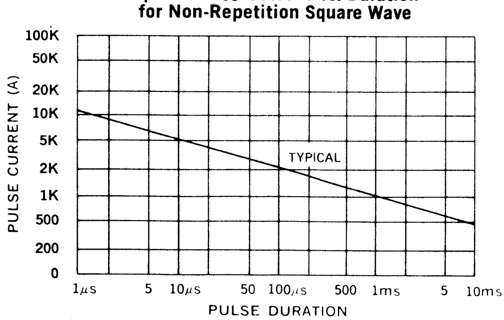
Output Current vs. Case Temp.



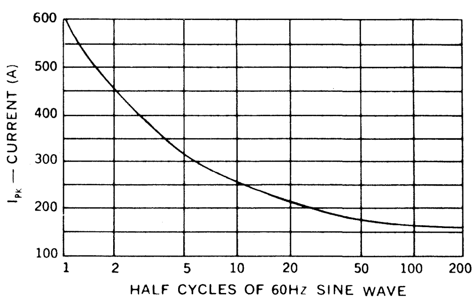
Pulse Thermal Impedance vs. Pulse Width



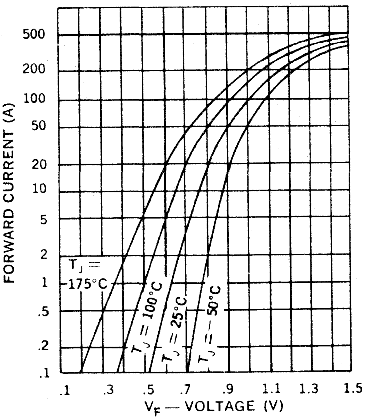
Square Pulse Current vs. Duration for Non-Repetition Square Wave



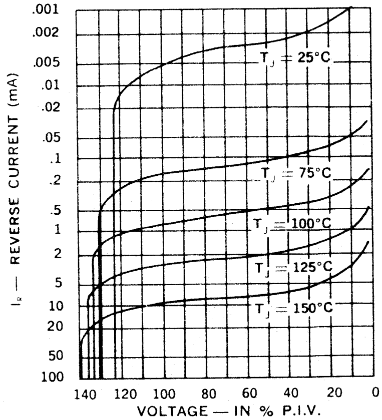
Multiple Surge Current vs. Duration



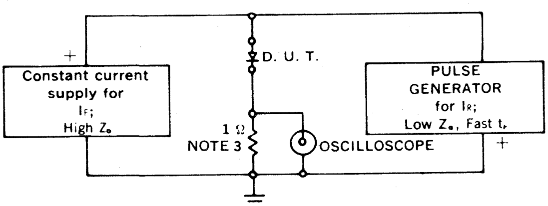
Typical Forward Current vs. Forward Voltage



Typical Reverse Current vs. Voltage



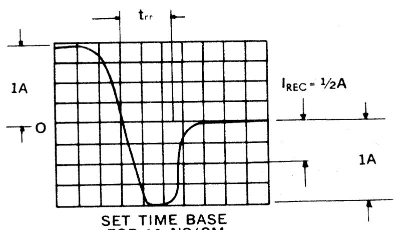
Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ≤ 3 ns; input impedance = 50 Ω.
2. Pulse Generator: Rise time ≤ 8 ns; source impedance 10 Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

Characteristic Waveform



RECTIFIERS
High Efficiency, 30A

UES601-UES603

FEATURES
- Very Low Forward Voltage
- Very Fast Switching Speeds
- High Surge Capability
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
This series consists of a power switching rectifier in a convenient TO-3 package. Although designed as a component for switching type power supplies, these devices can be used in any circuit in which fast switching and/or high efficiency is required.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES601	50V
Peak Inverse Voltage, UES602	100V
Peak Inverse Voltage, UES603	150V
Maximum Average D.C. Output Current at $T_C = 100°C$	30A
Non-Repetitive Sinusoidal Surge Current 8.3 ms	800A
Thermal Resistance, Junction to Case	1°C/W
Operating and Storage Temperature Range	−55°C to +175°C

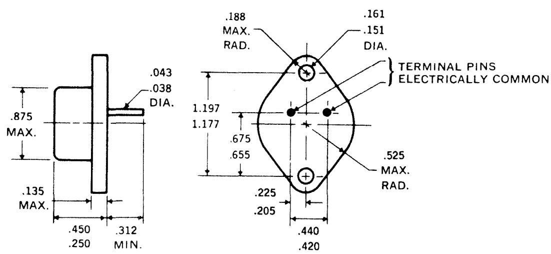
POWER CYCLING
These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS
The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

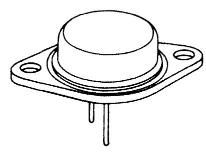
MECHANICAL SPECIFICATIONS

UES601-UES603



Dimensions in inches.

TO-3



Note:
Standard polarity is cathode-to-case.
For reverse polarity (anode-to-case) add suffix "R", ie. UES601R.

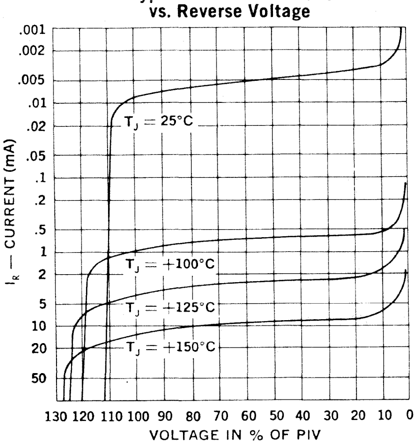
UNITRODE

ELECTRICAL SPECIFICATIONS

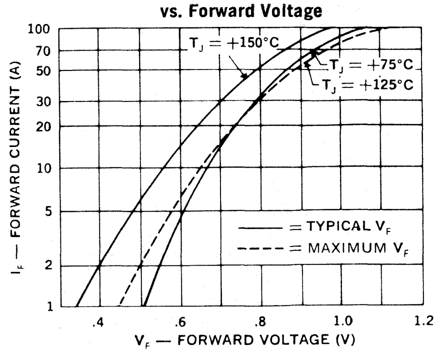
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES601 UES602 UES603	50V 100V 150V	.915V @ 30A $t_p = 300\mu S$	.800V @ 30A $t_p = 300\mu S$	25μA	10mA	50nsec

***Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$**

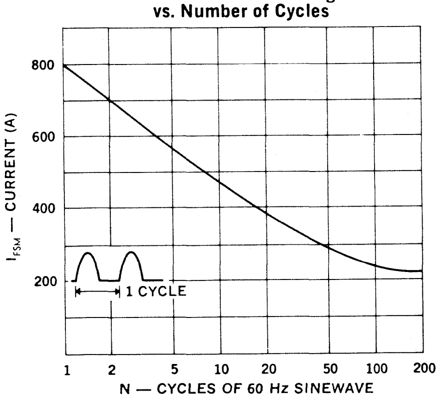
Typical Reverse Current vs. Reverse Voltage



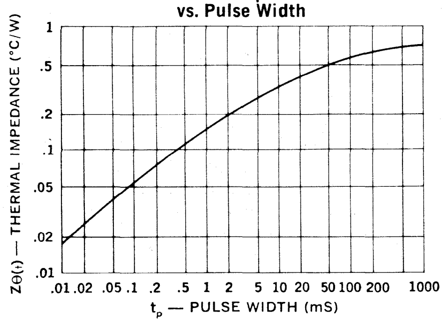
Forward Current vs. Forward Voltage



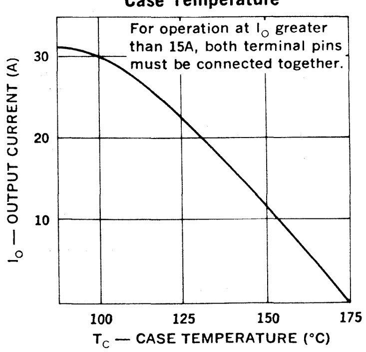
Maximum Forward Surge vs. Number of Cycles



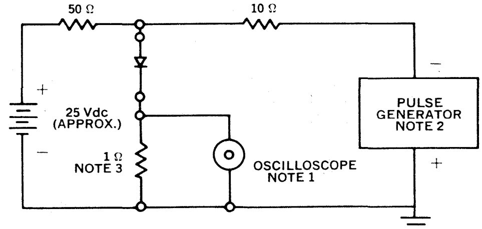
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 30A

UES604–UES606

FEATURES
- Very Low Forward Voltage
- Very Fast Switching Speeds
- High Surge Capability
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
This series consists of a power switching rectifier in a convenient TO-3 package. Although designed as a component for switching type power supplies, these devices can be used in any circuit in which fast switching and/or high efficiency is required.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES604	200V
Peak Inverse Voltage, UES605	300V
Peak Inverse Voltage, UES606	400V
Maximum Average D.C. Output Current @ $T_C = 100°C$	30A
Surge Current, 8.3 mSec	600A
Thermal Resistance, Junction to Case	1°C/W
Operating and Storage Temperature Range	−55°C to +150°C

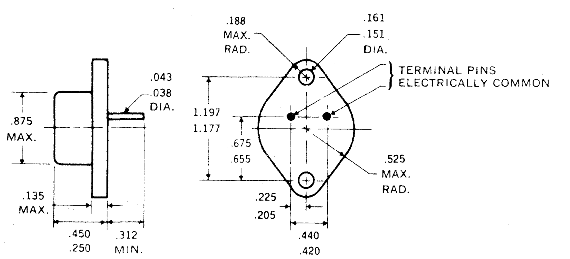
POWER CYCLING
These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS
The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

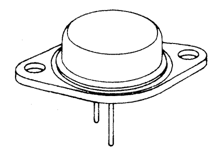
MECHANICAL SPECIFICATIONS

UES604-UES606



Dimensions in inches.

TO-3



Note:
Standard polarity is cathode-to-case.
For reverse polarity (anode-to-case) add suffix "R", ie. UES604R

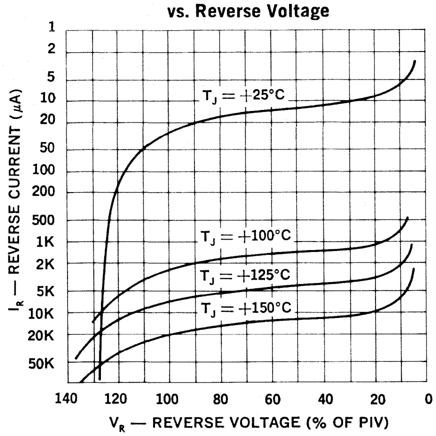
UNITRODE

ELECTRICAL SPECIFICATIONS

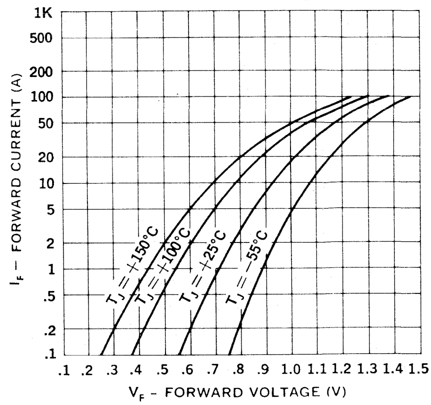
Type	PIV	Maximum Forward Voltage $T_C = 25°C$	Maximum Forward Voltage $T_C = 125°C$	Maximum Reverse Current $T_C = 25°C$	Maximum Reverse Current $T_C = 125°C$	Maximum Reverse Recovery Time*
UES604 UES605 UES606	200V 300V 400V	1.20V @ $I_F = 30A$ $t_p = 300\mu S$	1.10V @ $I_F = 30A$ $t_p = 300\mu S$	70μA	30mA	50nS

*Measured in circuit $I_F = 1/2A$, $I_R = 1A$, $I_{REC} = 1/4A$

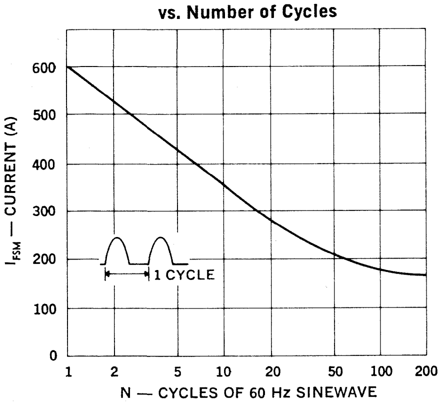
Typical Reverse Current vs. Reverse Voltage



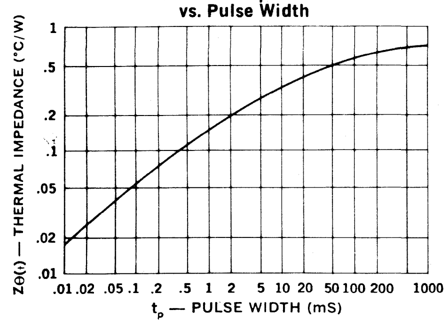
Forward Current vs. Forward Voltage



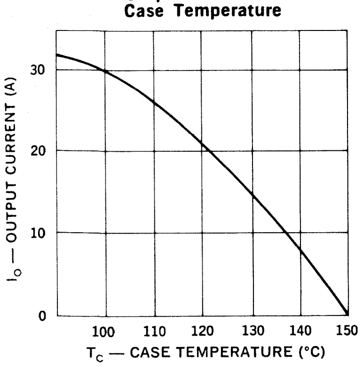
Maximum Forward Surge vs. Number of Cycles



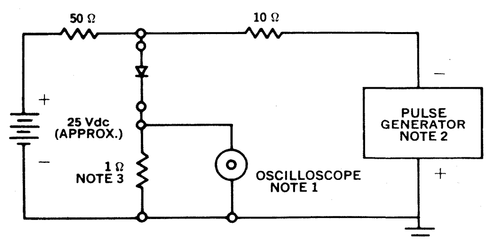
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

UNITRODE CORPORATION • 580 PLEASANT ST.
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TWX (710) 327-1296 • TELEX 922-414

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RECTIFIERS
High Efficiency, 25 A

UES701–UES703

FEATURES
- Low Forward Voltage
- Very Fast Switching
- Low Thermal Resistance
- High Surge Capability
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
Designed to meet the efficiency demand of switching type power supplies, these devices are useful in many switching applications.
The low thermal resistance and forward voltage drop of this series allows the user to replace DO-5 size devices in many applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES701	50V
Peak Inverse Voltage, UES702	100V
Peak Inverse Voltage, UES703	150V
Maximum Average D.C. Output Current at $T_C = 100°C$	25A
Non-Repetitive Sinusoidal Surge Current at 8.3ms	400A
Thermal Resistance, Junction to Case	1.5°C/W
Operating and Storage Temperature Range	−55°C to +175°C

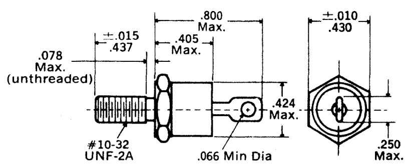
POWER CYCLING
These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS
The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

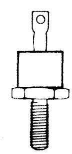
MECHANICAL SPECIFICATIONS

UES701-UES703



Dimension in inches.

DO-4



Notes:
1. Standard polarity is cathode-to-stud.
   For reverse Polarity (anode-to-stud) add suffix "R", ie. UES701R.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 15 inch pounds.
4. Angular orientation of terminal is undefined.

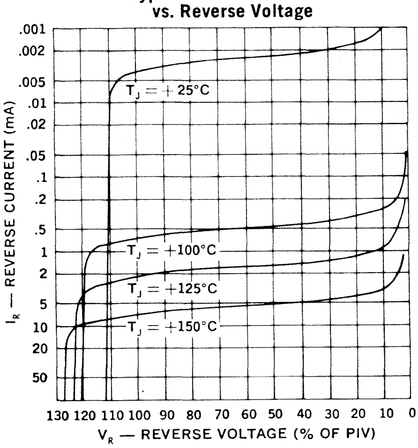
UNITRODE

ELECTRICAL SPECIFICATIONS

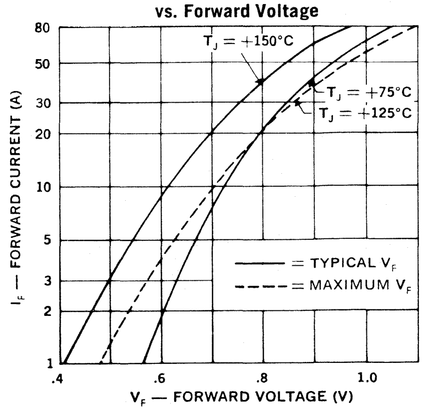
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES701 UES702 UES703	50V 100V 150V	.950 @ 25A $t_p = 300\mu S$	.825 @ 25A $t_p = 300\mu S$	$20\mu A$	4mA	35nsec

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

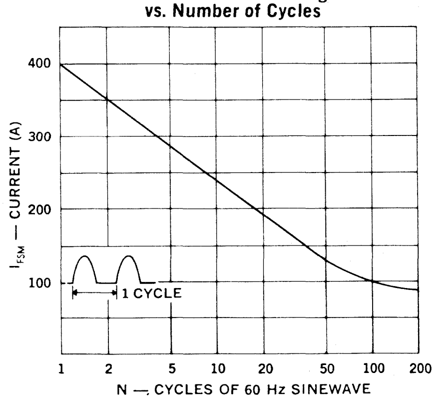
Typical Reverse Current vs. Reverse Voltage



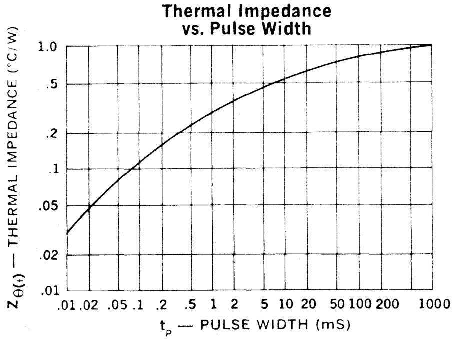
Forward Current vs. Forward Voltage



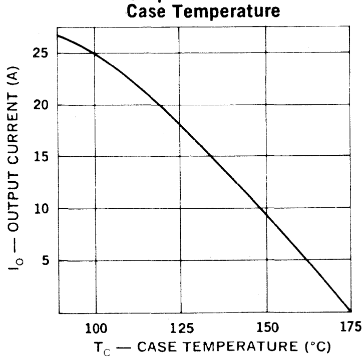
Maximum Forward Surge vs. Number of Cycles



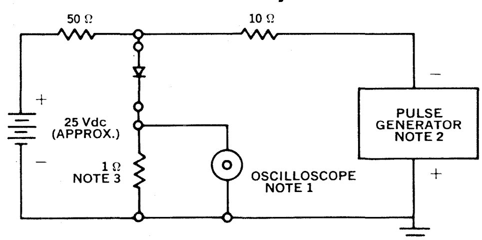
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 20A

UES704–UES706

FEATURES
- Low Forward Voltage
- Very Fast Switching
- Low Thermal Resistance
- High Surge Capability
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
Designed to meet the efficiency demand of switching type power supplies, these devices are useful in many switching applications.
The low thermal resistance and forward voltage drop of this series allows the user to replace DO-5 size devices in many applications.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES704	200V
Peak Inverse Voltage, UES705	300V
Peak Inverse Voltage, UES706	400V
Ave. D.C. Output Current, I_O @ $T_C = 100°C$	20A
Surge Current, 8.3mSec	300A
Thermal Resistance, Junction to Case	1.5°C/W
Operating and Storage Temperature Range	−55°C to +150°C

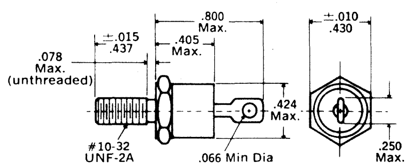
POWER CYCLING
These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS
The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

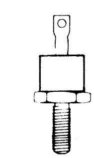
MECHANICAL SPECIFICATIONS

UES704-UES706



Dimension in inches.

DO-4



Notes:
1. Standard polarity is cathode-to-stud.
   For reverse Polarity (anode-to-stud) add suffix "R", ie. UES704R.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 15 inch pounds.
4. Angular orientation of terminal is undefined.

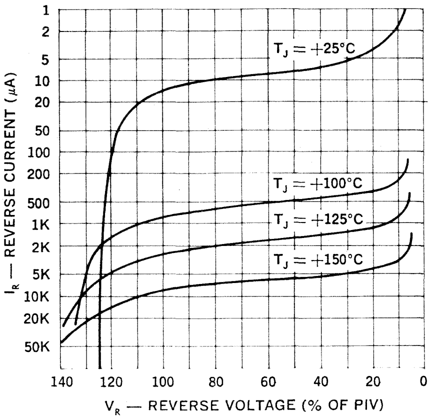
UNITRODE

ELECTRICAL SPECIFICATIONS

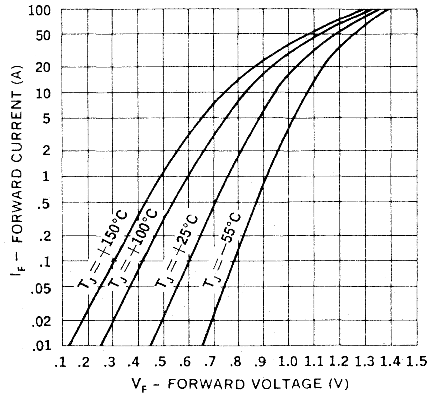
Type	PIV	Maximum Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES704 UES705 UES706	200V 300V 400V	1.25V @ 20A $t_p = 300\mu S$	1.15V @ 20A $t_p = 300\mu S$	50μA	10mA	50nS

*Measured in circuit $I_F = ½A$, $I_R = 1A$, $I_{REC} = ¼A$

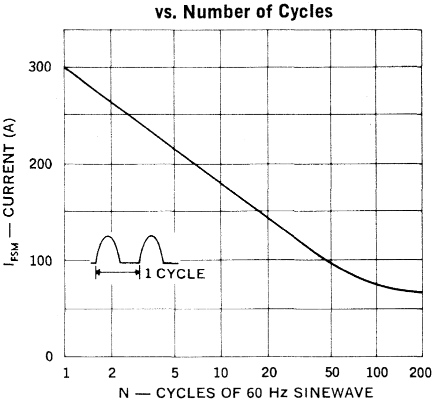
Typical Reverse Current vs. Reverse Voltage



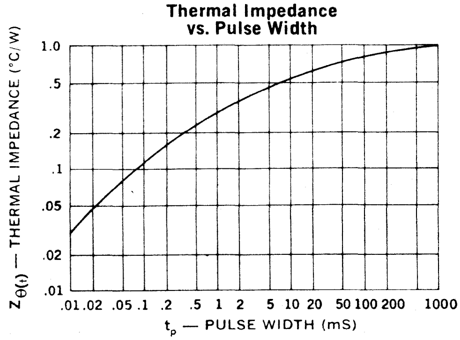
Forward Current vs. Forward Voltage



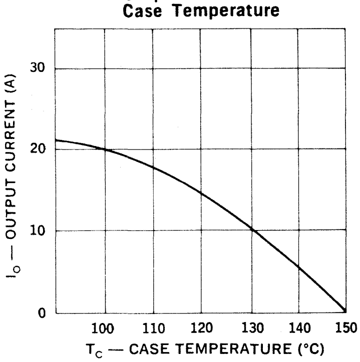
Maximum Forward Surge vs. Number of Cycles



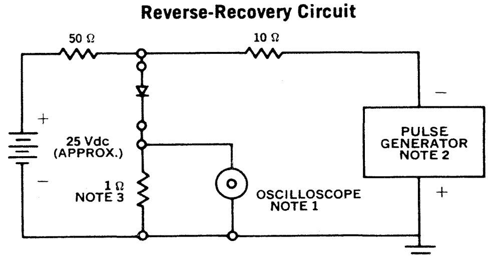
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

UNITRODE CORPORATION • 580 PLEASANT ST.
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TWX (710) 327-1296 • TELEX 922-414

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RECTIFIERS
High Efficiency, 70 A

UES801-UES803

FEATURES
- High Continuous Current Rating
- Very Low Forward Voltage
- Very Fast Switching Speeds
- High Surge Capability
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
The UES801 Series is specifically designed for operation in power switching circuits operating at frequencies of at least 20 KHz. The very low forward voltage and very fast recovery time make them particularly suited for switching type power supplies.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES801	50V
Peak Inverse Voltage, UES802	100V
Peak Inverse Voltage, UES803	150V
Maximum Average D.C. Output Current at $T_C = 100°C$	70A
Non-Repetitive Sinusoidal Surge Current 8.3 ms	800A
Thermal Resistance, Junction to Case	0.8°C/W
Operating and Storage Temperature Range	−55°C to +175°C

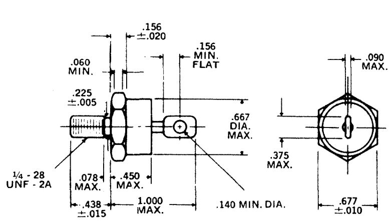
POWER CYCLING
These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS
The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

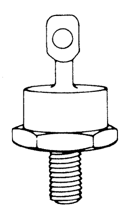
MECHANICAL SPECIFICATIONS

UES801-UES803



Dimensions in inches.

DO-5



Notes:
1. Standard polarity is cathode-to-stud.
   For reverse polarity (anode-to-stud) add suffix "R", ie. UES801R.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

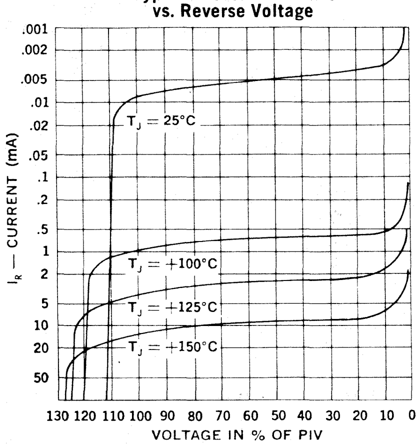
UNITRODE

ELECTRICAL SPECIFICATIONS

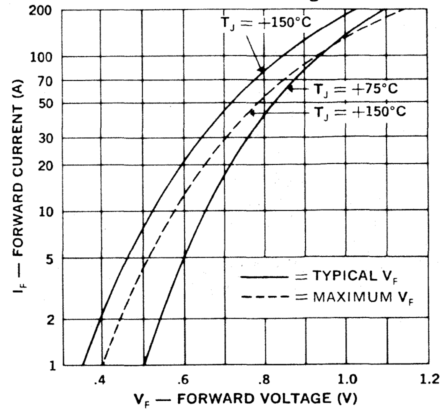
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 150°C$	$T_C = 25°C$	$T_C = 150°C$	
UES801 UES802 UES803	50V 100V 150V	.975V @ 70A $t_p = 300\mu S$	.840V @ 70A $t_p = 300\mu S$	25μA	30mA	50nsec

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

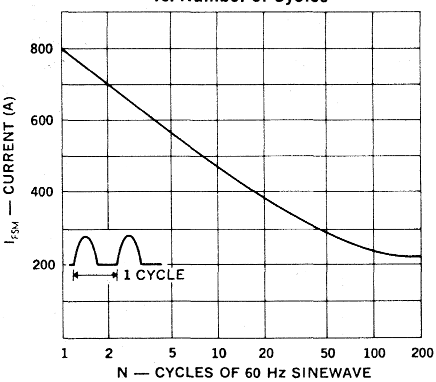
Typical Reverse Current vs. Reverse Voltage



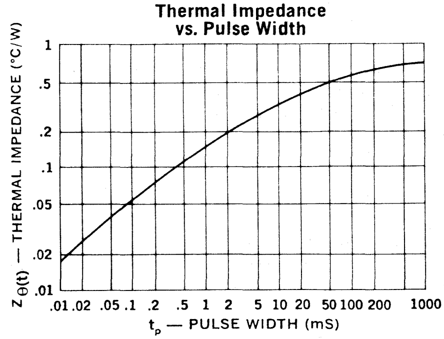
Forward Current vs. Forward Voltage



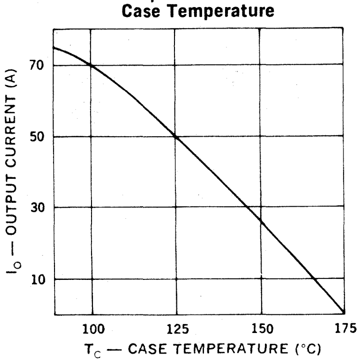
Maximum Forward Surge vs. Number of Cycles



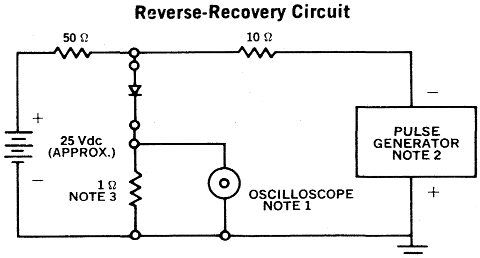
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 50A

UES804–UES806

FEATURES
- High Continuous Current Rating
- Very Low Forward Voltage
- Very Fast Switching Speeds
- High Surge Capability
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
The UES804 Series is specifically designed for operation in power switching circuits operating at frequencies of at least 20 KHz. The very low forward voltage and very fast recovery time make them particularly suited for switching type power supplies.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES804	200V
Peak Inverse Voltage, UES805	300V
Peak Inverse Voltage, UES806	400V
Maximum Average D.C. Output Current @ $T_C = 100°C$	50A
Surge Current, 8.3mSec	600A
Thermal Resistance, Junction to Case	.8°C/W
Operating and Storage Temperature Range	−55°C to +150°C

POWER CYCLING

These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

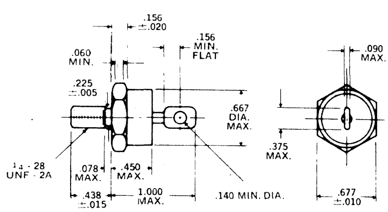
In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS

The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

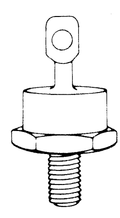
MECHANICAL SPECIFICATIONS

UES804-UES806



Dimensions in inches.

DO-5



Notes:
1. Standard polarity is cathode-to-stud. For reverse polarity (anode-to-stud) add suffix "R", ie. UES804R.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

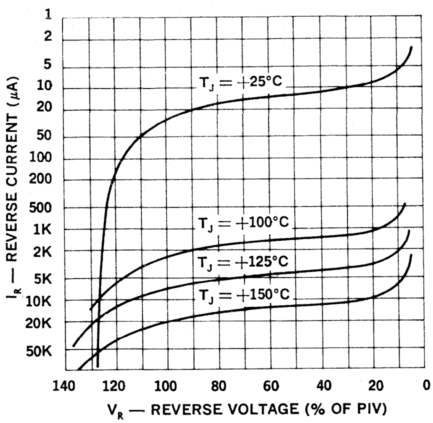
UNITRODE

ELECTRICAL SPECIFICATIONS

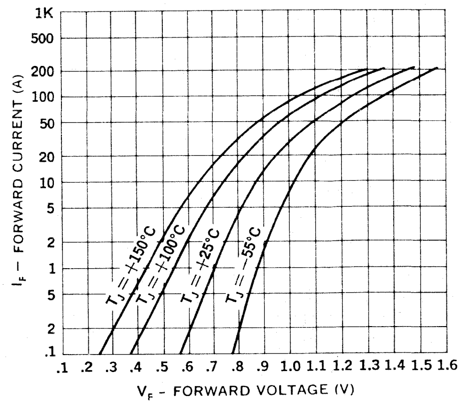
Type	PIV	Maximum Forward Voltage		Maximum Reverse Curent		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES804 UES805 UES806	200V 300V 400V	1.25V @ $I_F = 50A$ $t_p = 300\mu S$	1.15V @ $I_F = 50A$ $t_p = 300\mu S$	$70\mu A$	30mA	50nS

*Measured in circuit $I_F = 1/2 A$, $I_R = 1.0A$, $I_{REC} = 1/4 A$

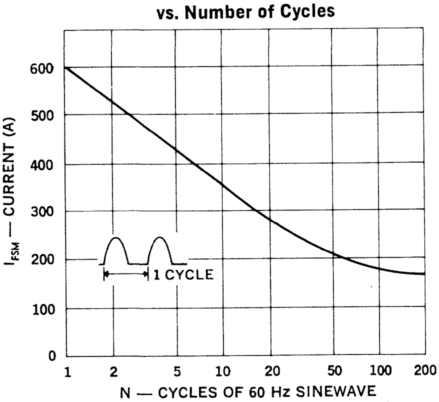
Typical Reverse Current vs. Reverse Voltage



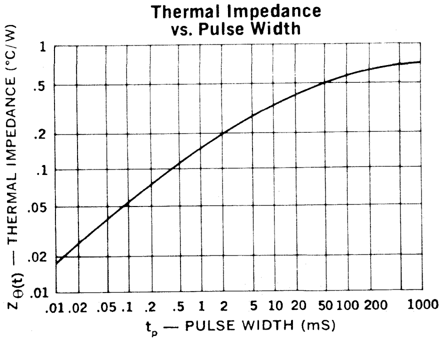
Forward Current vs. Forward Voltage



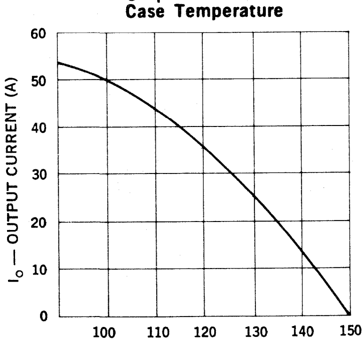
Maximum Forward Surge vs. Number of Cycles



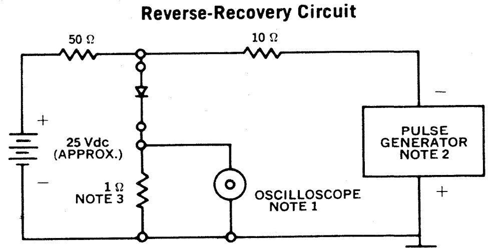
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 2.5A

UES1101-UES1103

FEATURES
- Very Fast Recovery Times
- Very Low Forward Voltage
- Small Size
- Convenient Package

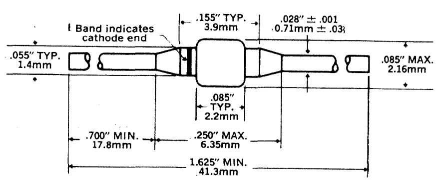
DESCRIPTION
An axial leaded power rectifier useful in many switching applications. Particularly suited where very fast recovery and low forward voltage are required.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES1101	50V
Peak Inverse Voltage, UES1102	100V
Peak Inverse Voltage, UES1103	150V
Maximum Average D.C. Output Current at $T_L = 75°C$, L = ⅜″	2.5A
Non-Repetitive Surge Current at 8.3 ms	35A
Thermal Resistance at L = ⅜″	38°C/W
Operating and Storage Temperature Range	−55°C +175°C

MECHANICAL SPECIFICATIONS

UES1101-UES1103



BODY A

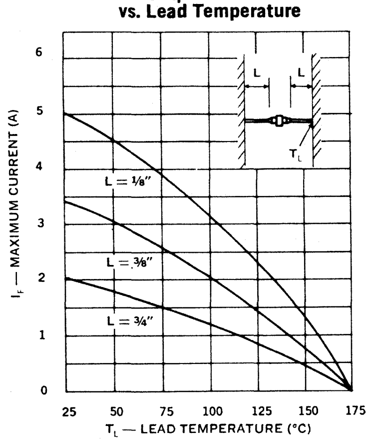
UNITRODE

ELECTRICAL SPECIFICATIONS

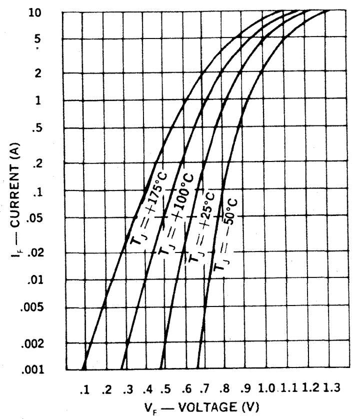
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_J = 25°C$	$T_J = 100°C$	$T_J = 25°C$	$T_J = 100°C$	
UES1101 UES1102 UES1103	50V 100V 150V	.975V @ 2A	.895V @ 2A	2μA	50μA	25nsec

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

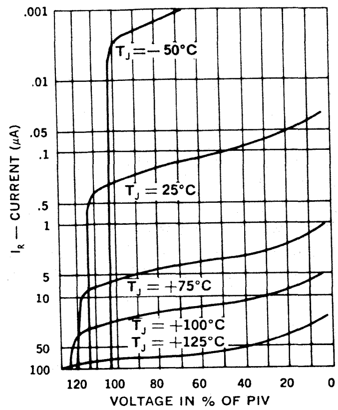
Output Current vs. Lead Temperature



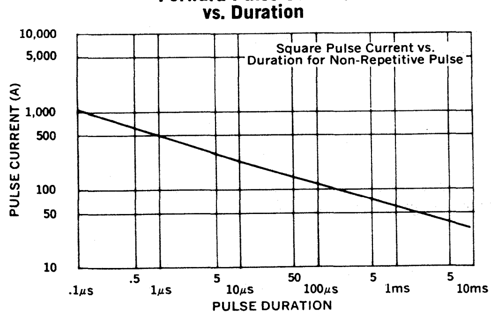
Typical Forward Current vs. Forward Voltage



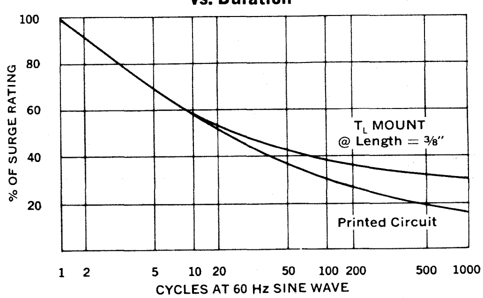
Typical Reverse Current vs. Voltage



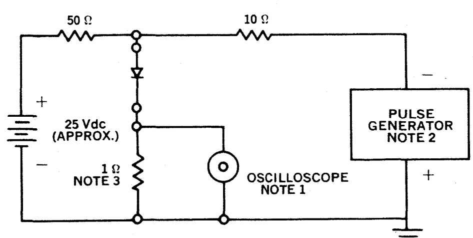
Forward Pulse Current vs. Duration



Multiple Surge Current vs. Duration



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 2A

UES1104–UES1106

FEATURES
- Very Fast Recovery Times
- Very Low Forward Voltage
- Small Size
- Convenient Package

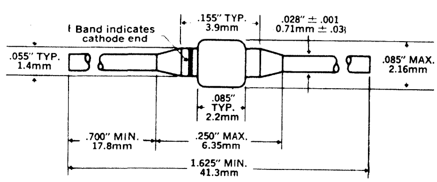
DESCRIPTION
An axial leaded power rectifier useful in many switching applications. Particularly suited where very fast recovery and low forward voltage are required.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES1104	200V
Peak Inverse Voltage, UES1105	300V
Peak Inverse Voltage, UES1106	400V
Maximum Average D.C. Output Current, I_O	
@ T_A = 25°C (Free Air)	1A
@ T_L = 50°C, L—⅜″	2A
Surge Current, 8.3mSec	20A
Thermal Resistance @ L = ⅜″	38°C/W
Operating and Storage Temperature Range	—55°C to +150°C

MECHANICAL SPECIFICATIONS

UES1104-UES1106



BODY A

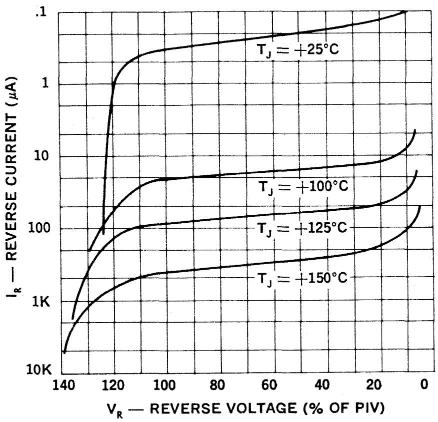
UNITRODE

ELECTRICAL SPECIFICATIONS

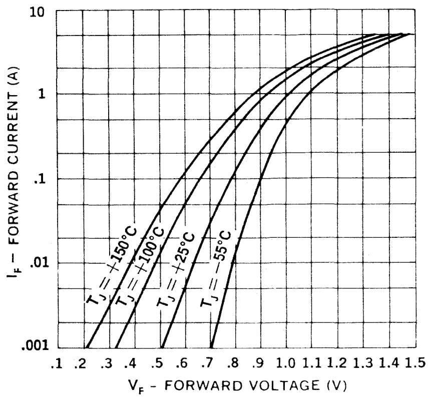
Type	PIV	Maximum Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
		$T_J = 25°C$	$T_J = 100°C$	@ PIV, $T_J = 25°C$	$T_J = 100°C$	
UES1104 UES1105 UES1106	200V 300V 400V	1.25V @ 1A	1.15V @ 1A	10μA	200μA	50nS

*Measured in circuit $I_F = ½A$, $I_R = 1NA$, $I_{REC} = 1NA$

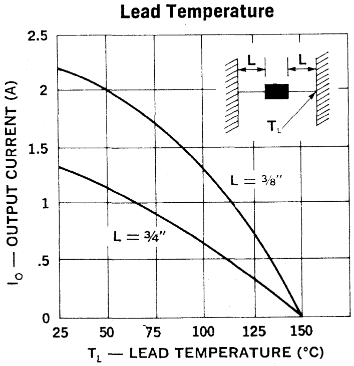
Typical Reverse Current vs. Reverse Voltage



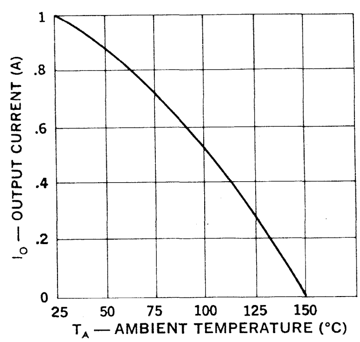
Forward Current vs. Forward Voltage



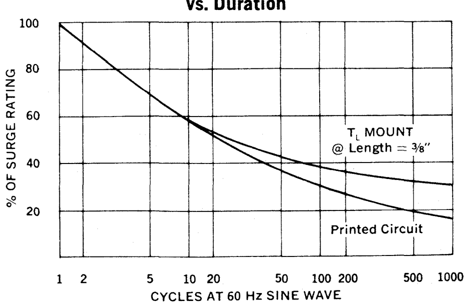
Output Current vs. Lead Temperature



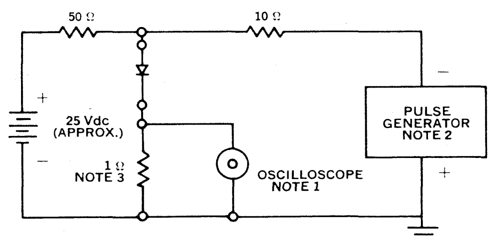
Output Current vs. Ambient Temperature



Multiple Surge Current vs. Duration



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 6A

UES1301-UES1303

FEATURES
- Very Low Forward Voltage
- Very Fast Recovery Times
- Small Size
- High Surge

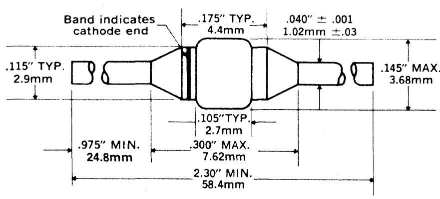
DESCRIPTION
Now power rectifiers in axial leaded package to meet the most demanding switching applications. An industrial product with military reliability.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES1301	50V
Peak Inverse Voltage, UES1302	100V
Peak Inverse Voltage, UES1303	150V
Maximum Average D.C. Output Current at $T_L = 75°C$, L = ⅜″	6.0A
Non-Repetitive Sinusoidal Surge Current at 8.3ms	125A
Thermal Resistance at L = ⅜″	20°C/W
Operating and Storage Temperature Range	—55°C to +175°C

MECHANICAL SPECIFICATIONS

UES1301-1303



BODY B

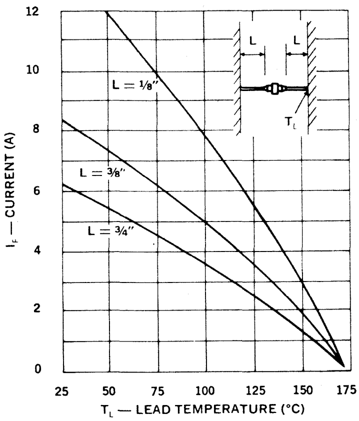
UNITRODE

ELECTRICAL SPECIFICATIONS

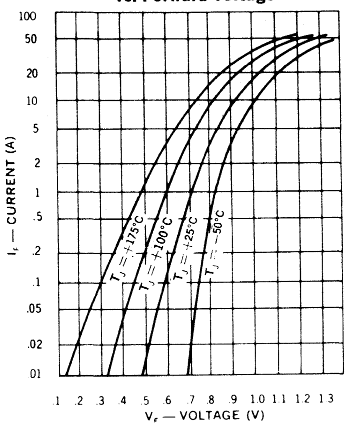
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_J = 25°C$	$T_J = 100°C$	$T_J = 25°C$	$T_J = 100°C$	
UES1301 UES1302 UES1303	50V 100V 150V	.925V @ 6A	.850V @ 6A	5μA	150μA	30nsec

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

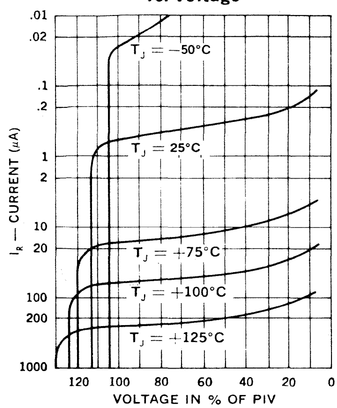
Output Current vs. Lead Temperature



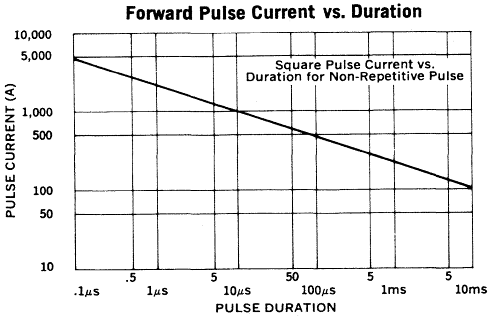
Typical Forward Current vs. Forward Voltage



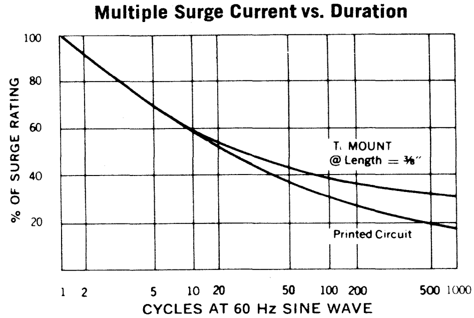
Typical Reverse Current vs. Voltage



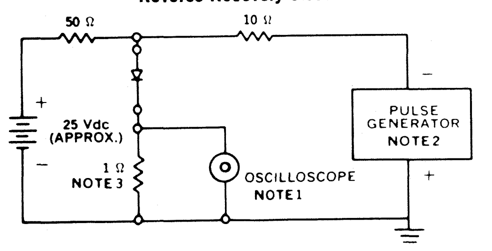
Forward Pulse Current vs. Duration



Multiple Surge Current vs. Duration



Reverse-Recovery Circuit



NOTES:

1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 5A

UES1304–UES1306

FEATURES
- Very Low Forward Voltage
- Very Fast Recovery Times
- Small Size
- High Surge

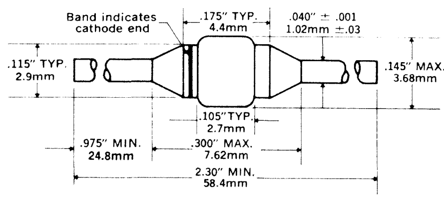
DESCRIPTION
Now power rectifiers in axial leaded package to meet the most demanding switching applications. An industrial product with military reliability.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES1304	200V
Peak Inverse Voltage, UES1305	300V
Peak Inverse Voltage, UES1306	400V
Maximum Average D.C. Output Current, I_O	
@ $T_A = 25°C$ (Free Air)	3A
@ $T_L = 50°C$, L = 3/8″	5A
Surge Current, 8.3mSec	70A
Thermal Resistance @ L — 3/8″	20°C/W
Operating and Storage Temperature Range	−55°C to +150°C

MECHANICAL SPECIFICATIONS

UES1304-1306



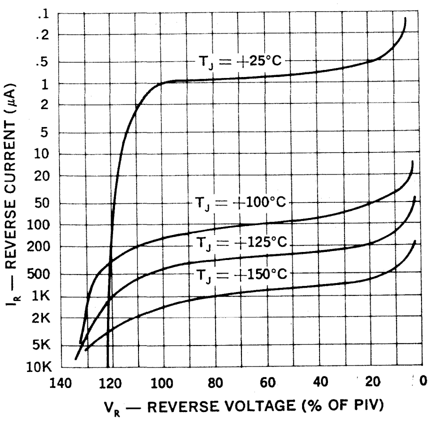
BODY B

UNITRODE

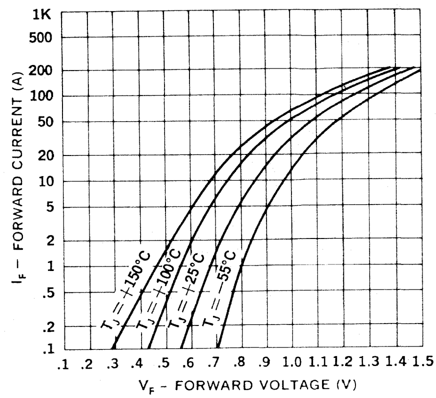
ELECTRICAL SPECIFICATIONS

Type	PIV	Maximum Forward Voltage @ $I_F = 3A$, $T_J = 25°C$	Maximum Forward Voltage $T_J = 100°C$	Maximum Reverse Current @ PIV, $T_J = 25°C$	Maximum Reverse Current $T_J = 100°C$	Maximum Reverse Recovery Time
UES1304 UES1305 UES1306	200V 300V 400V	1.25V	1.15V	20μA	500μA	50nSec

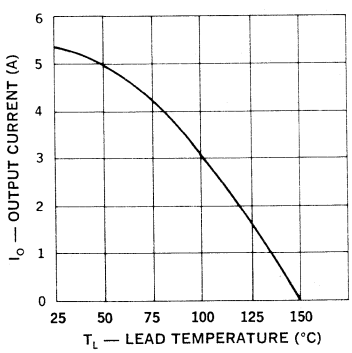
Typical Reverse Current vs. Reverse Voltage



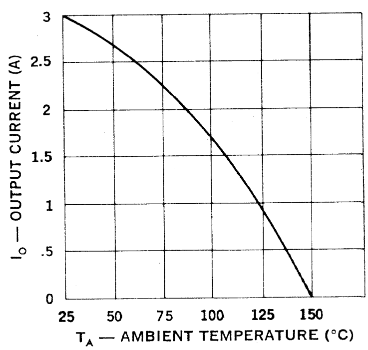
Forward Current vs. Forward Voltage



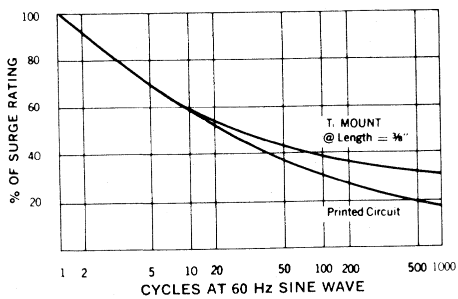
Output Current vs. Lead Temperature



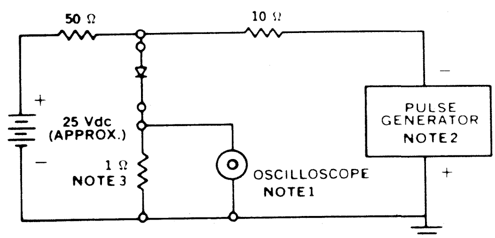
Output Current vs Ambient Temperature



Multiple Surge Current vs. Duration



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIERS
High Efficiency, 30A Center-Tap

UES-2601–UES2603

FEATURES
- Very Low Forward Voltage
- Very Fast Switching Speed
- Convenient Package
- High Surge
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION
This series combines two high efficiency devices into one package, simplifying installation, reducing heat sink requirements and the need to purchase matched components.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES2601	50V
Peak Inverse Voltage, UES2602	100V
Peak Inverse Voltage, UES2603	150V
Maximum Average D.C. Output Current at $T_C = 100°C$	30A
Non-Repetitive Sinusoidal Surge Current 8.3 ms	400A
Thermal Resistance, Junction to Case	1°C/W
Operating and Storage Temperature Range	−55°C to +175°C

POWER CYCLING

These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

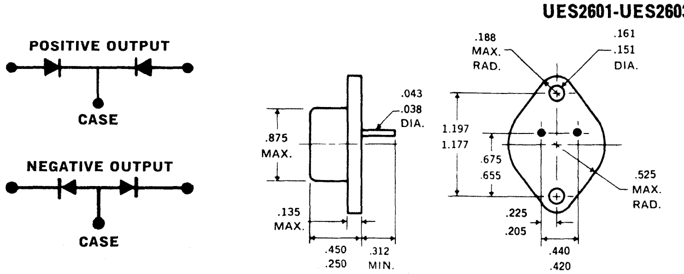
In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

SWITCHING CHARACTERISTICS

The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

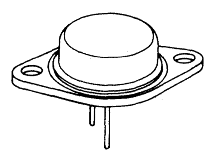
MECHANICAL SPECIFICATIONS

UES2601-UES2603



Dimensions in inches.

TO-3



Note:
Standard polarity is positive output.
For reverse polarity (negative output) add suffix "R", ie. UES2601R.

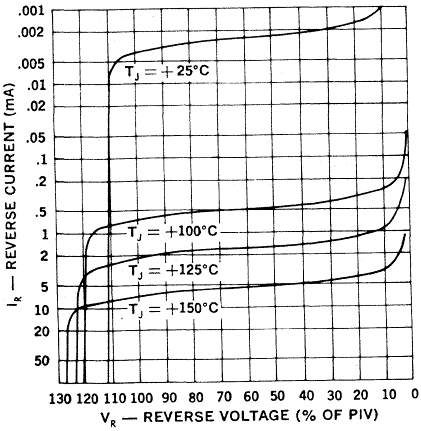
UNITRODE

ELECTRICAL SPECIFICATIONS

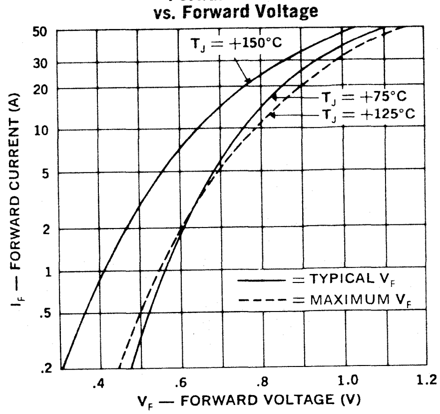
Type	PIV	Maximum Forward Voltage @		Maximum Reverse Current @		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES2601 UES2602 UES2603	50V 100V 150V	.930V @ 15A $t_p = 300\mu S$	.825V @ 15A $t_p = 300\mu S$	20μA	4mA	35nsec

*Measured in circuit $I_F = ½A$, $I_R = 1.0A$, $I_{REC} = ¼A$

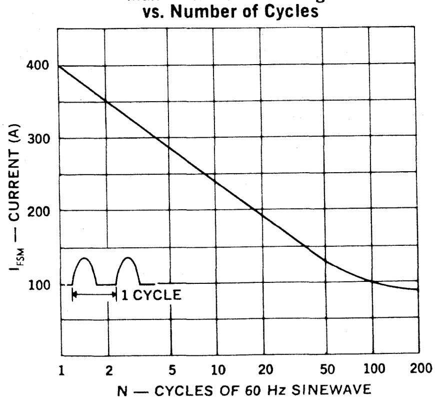
Typical Reverse Current vs. Reverse Voltage



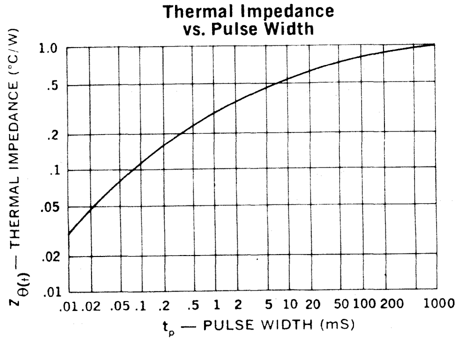
Forward Current vs. Forward Voltage



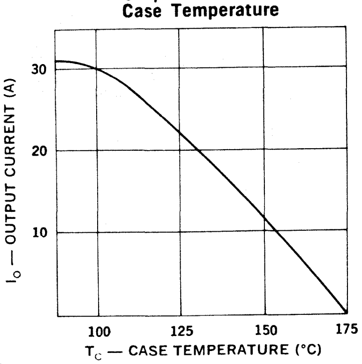
Maximum Forward Surge vs. Number of Cycles



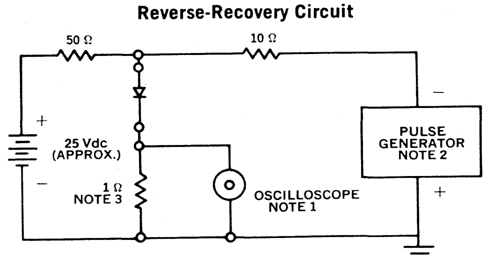
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ≤ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ≤ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

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RECTIFIERS

UES2604–UES2606

High Efficiency, 30A Center-Tap

FEATURES

- Very Low Forward Voltage
- Very Fast Switching Speed
- Convenient Package
- High Surge
- Low Thermal Resistance
- Mechanically Rugged
- Both Polarities Available

DESCRIPTION

This series combines two high efficiency devices into one package, simplifying installation, reducing heat sink requirements and the need to purchase matched components.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, UES2604	200V
Peak Inverse Voltage, UES2605	300V
Peak Inverse Voltage, UES2606	400V
Maximum Average D.C. Output Current @ $T_C = 100°C$	30A
Surge Current, 8.3nSec	300A
Thermal Resistance, Junction to Case	1°C/W
Operating and Storage Temperature Range	—55 to +150°C

POWER CYCLING

These devices possess the unique ability to pass many thousands of cycles of a stress test designed to evaluate the integrity of the bonding systems used in the construction of power rectifiers.

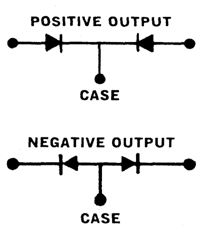
In this stress test, the case of the device is not heat sunk. Full rated forward current is supplied to force a case temperature increase at least 75°C, at which time, the current is removed and the case allowed to cool. The cycle is repeated a minimum of 5,000 times to simulate equipment being turned on and off. Extended power cycling tests demonstrate a product capability in excess of 25,000 cycles.

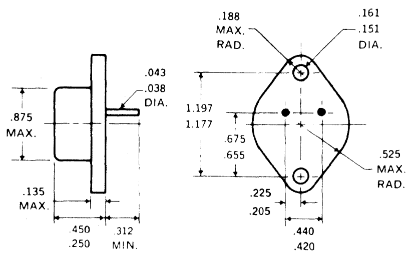
SWITCHING CHARACTERISTICS

The switching times of these ultra-fast rectifiers increase relatively little, with temperature or at different currents. Even in severe applications, such as catch diodes for switching regulators and output rectifiers for high frequency square wave inverters, these devices switch many times faster than the fastest associated transistors. Thus, the stresses on and powers dissipated in the switching transistors are substantially less than when using other rectifiers.

MECHANICAL SPECIFICATIONS

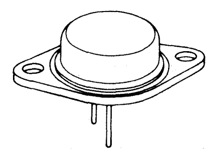
UES2604-UES2606





Dimensions in inches.

TO-3



Note:
Standard polarity is positive output.
For reverse polarity (negative output) add suffix "R", ie. UES2604R.

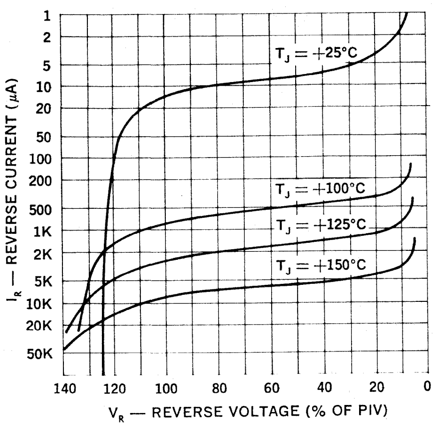
UNITRODE

ELECTRICAL SPECIFICATIONS, PER LEG

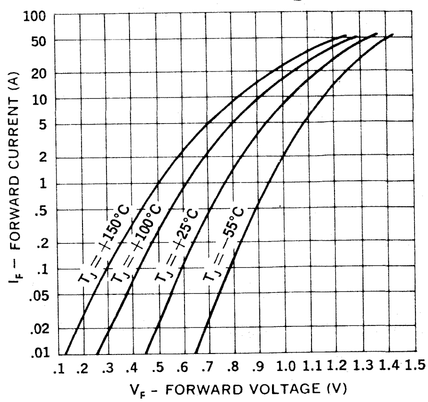
Type	PIV	Maximum Forward Voltage		Maximum Reverse Current		Maximum Reverse Recovery Time*
		$T_C = 25°C$	$T_C = 125°C$	$T_C = 25°C$	$T_C = 125°C$	
UES2604 UES2605 UES2606	200V 300V 400V	1.25V @ 15A $t_p = 300\mu S$	1.15V @ 15A $t_p = 300\mu S$	50μA	10mA	50nS

*Measured in circuit $I_F = ½A$, $I_R = 1A$, $I_{REC} = ¼A$

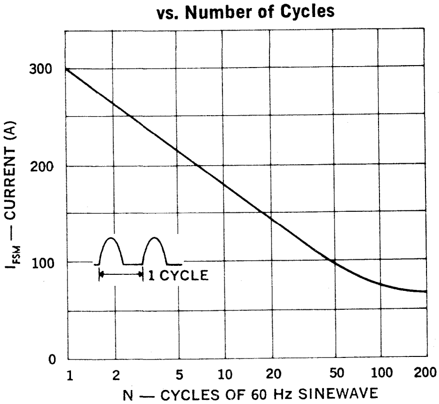
Typical Reverse Current vs. Reverse Voltage



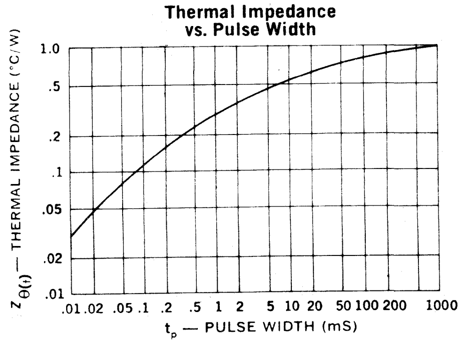
Forward Current vs. Forward Voltage



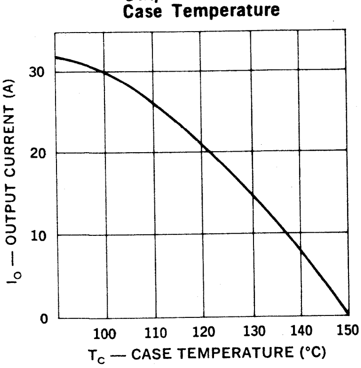
Maximum Forward Surge vs. Number of Cycles



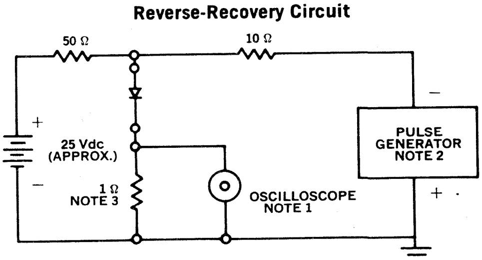
Thermal Impedance vs. Pulse Width



Output Current vs. Case Temperature



Reverse-Recovery Circuit



NOTES:
1. Oscilloscope: Rise time ⩽ 3ns; input impedance = 50Ω.
2. Pulse Generator: Rise time ⩽ 8ns; source impedance 10Ω.
3. Current viewing resistor, non-inductive, coaxial recommended.

RECTIFIER ASSEMBLIES

UFB, UFS, USB, USS SERIES

High Voltage Stacks, Standard and Fast Recovery

FEATURES
- Controlled Avalanche Characteristics
- Only Fused-in-Glass Diodes Used
- High Forward and Reverse Surge Capability
- Transfer Molded for Voidless Construction
- Modular for Easy Stacking
- PIV: from 2.5 kV to 15 kV
- Recovery Times: to 500ns
- Continuous Ratings: to 2.3A

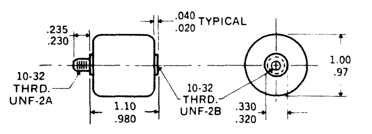
DESCRIPTION
These assemblies uniquely combine a versatile stackable design with all the requirements for reliable high voltage operation. All modules are suitable for bridge or series operations.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage, USS Series	5.0 kV to 15 kV
Peak Inverse Voltage, USB Series	2.5 kV to 10 kV
Peak Inverse Voltage, UFS Series	5.0 kV to 10 kV
Peak Inverse Voltage, UFB Series	2.5 kV to 7.5 kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	—65°C to +150°C

MECHANICAL SPECIFICATIONS

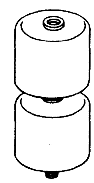
UFB, UFS, USB, USS SERIES



Typical Weight: USS & UFS Series — 1.0 ounce
28 grams

USB & UFB Series — 1.1 ounce
31 grams

Dimensions in inches.



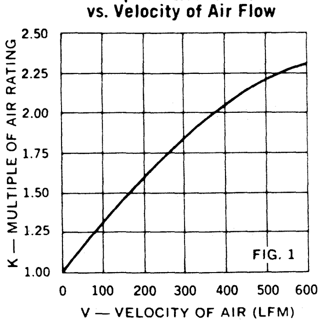
MARKING
Type number marked on unit.
Polarity — Cathode connected to stud.

UNITRODE

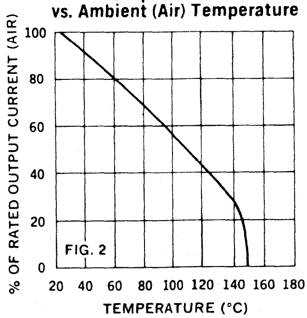
Electrical Specifications (at 25°C unless noted)							Maximum Ratings		
							Maximum Average D.C. Output Current		
Type		PIV	Maximum Forward Voltage Drop	Leakage Current @ PIV	Maximum Reverse Recovery Time	Maximum Reverse Transient Energy Absorption	$T_A = 25°C$ AIR	$T_A = 50°C$ OIL	Non-Repetitive Sinusoidal Surge (8.3ms)
		kV		μA	ns	joules	Amps	Amps	Amps
Standard Recovery	USS 5	5.0	9V @ 0.6A	5	—	1.5	0.60	1.1	25
	USS 7.5	7.5	13V @ 0.5A			2.5	0.45	0.91	
	USS 10	10	17V @ 0.3A			3.0	0.35	0.71	
	USS 15	15	25V @ 0.2A			5.0	0.25	0.51	
Standard Recovery	USB 2.5	2.5	5V @ 1.1A	10	—	3.0	1.1	2.3	80
	USB 5	5.0	9V @ 0.7A			6.0	0.68	1.5	
	USB 7.5	7.5	13V @ 0.5A			9.0	0.53	1.2	
	USB 10	10	17V @ 0.4A			12	0.43	1.0	
Fast Recovery	UFS 5	5.0	12V @ 0.5A	5	500* 350†	1.5	0.50	0.90	20
	UFS 7.5	7.5	18V @ 0.4A			2.5	0.38	0.75	
	UFS 10	10	23V @ 0.3A			3.0	0.30	0.58	
Fast Recovery	UFB 2.5	2.5	6V @ 0.9A	10	500* 350†	3.0	0.90	2.0	70
	UFB 5	5.0	12V @ 0.6A			6.0	0.58	1.3	
	UFB 7.5	7.5	18V @ 0.4A			9.0	0.45	1.0	

*Measured in a reverse recovery circuit switching from 1A forward to 1A reverse current recovering to 0.5A.
†Measured in a reverse recovery circuit switching from .5A foward current to 1A reverse current, recovery to .25A.

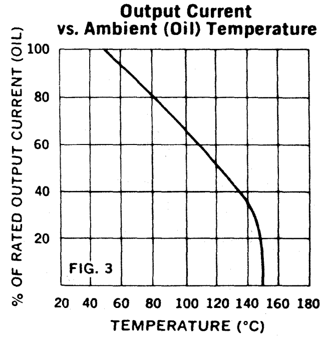
Output Current Ratio vs. Velocity of Air Flow



Output Current vs. Ambient (Air) Temperature

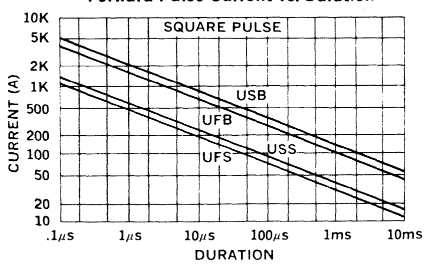


Output Current vs. Ambient (Oil) Temperature

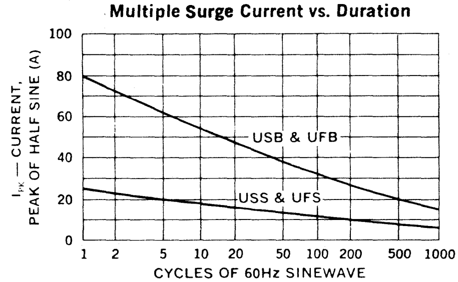


Application example: The rectifier is to be used in a cabinet at 60°C with ambient air moving at 400 LFM. The rating is reduced (Fig. 2) by a factor of 0.81 due to the elevated temperature, but it is enhanced by 2 X (Fig. 1) due to the air flow. Hence the DC output current is 0.81 x 2, or 1.6 times the 25°C air rating.

Forward Pulse Current vs. Duration



Multiple Surge Current vs. Duration



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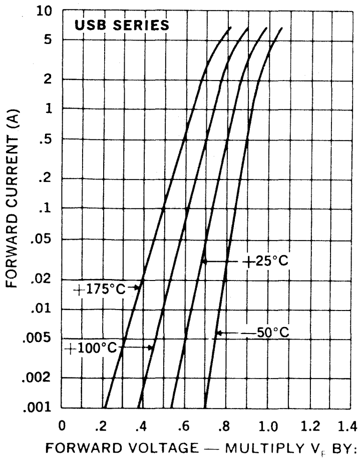
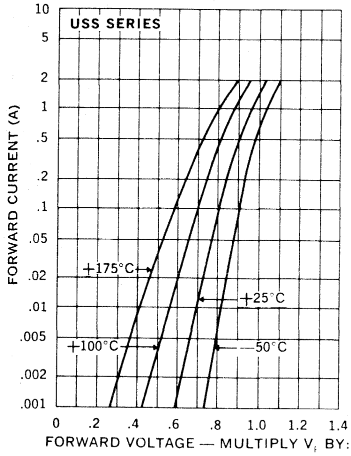
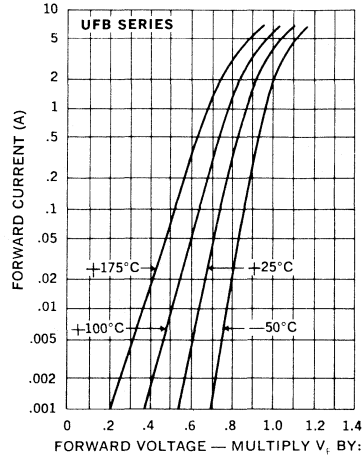
Typical Forward Voltage vs. Forward Current



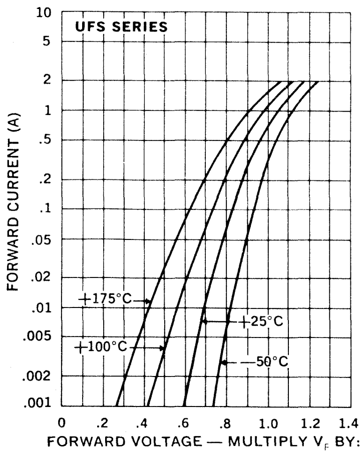
Typical Forward Voltage vs. Forward Current



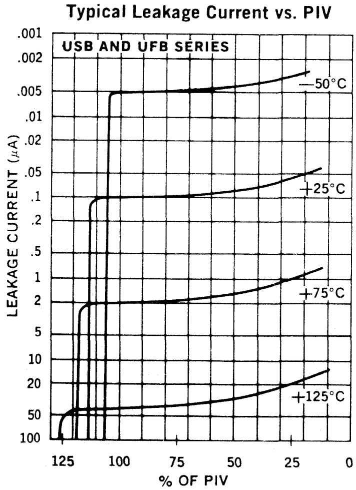
Typical Forward Voltage vs. Forward Current



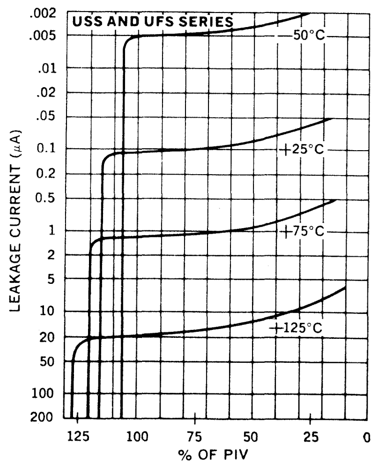
Typical Forward Voltage vs. Forward Current



Typical Leakage Current vs. PIV



Typical Leakage Current vs. PIV



RECTIFIER ASSEMBLIES

UGB, UGD, UGE, UGF SERIES

High Voltage Doorbell® Modules
Standard and Fast Recovery

FEATURES
- Current Ratings: to 10A
- PIV: 2.5 kV to 10kV
- Recovery Times: to 500ns
- Only Fused-in-Glass Diodes Used
- Controlled Avalanche Characteristics
- Stackable to 600kV
- Modular Package for Easy Stacking

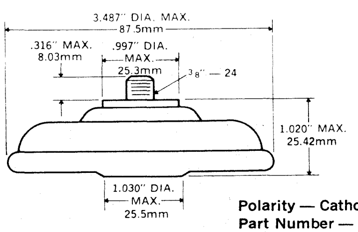
DESCRIPTION
This series of high-voltage, high-current stacks that incorporate a unique modular design makes it particularly well-suited for high power applications such as in radar systems as charge, hold-off and clipper diodes.

ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	
UGB, UGD Series	5 kV to 10 kV
UGS, UGF Series	2.5 kV to 7.5 kV
Maximum Average D.C. Output Current	See Electrical Specifications
Non-repetitive Sinusoidal Surge (8.3ms)	See Electrical Specifications
Operating and Storage Temperature Range	−65°C to +150°C

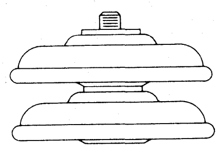
MECHANICAL SPECIFICATIONS

UGB, UGD, UGE, UGF SERIES

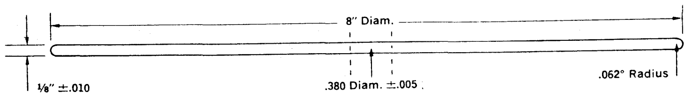


Polarity — Cathode connected to base.
Part Number — On base of unit.

Typical Weight — 7.0 ounces 200 grams



EXTENDER PLATE G



Typical Weight — 9.25 ounces 265 grams

Dimensions in inches.

UNITRODE

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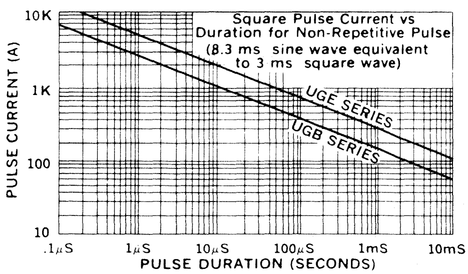
Electrical Specifications (at 25°C unless noted)						Maximum Ratings				
						Maximum Average D.C. Output Current			Non-repetitive Sinusoidal Surge (8.3ms)	Maximum Reverse Transient Energy Absorption
Type		PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV	Maximum Reverse Recovery Time	$T_C = 75°C$ Air	$T_C = 60°C$ Air with Extender Plate**	$T_C = 50°C$ Oil	$T_C = 100°C$	
		kV		μA	ns	Amps	Amps	Amps	Amps	joules
Standard Recovery	UGE-2.5	2.5	5V @ 3.30A	10		6.60	8.25	10.00	200	8
	UGE-5	5	10V @ 2.50A	15		5.00	6.25	7.50	200	14
	UGB-5	5	9V @ 2.20A	5	—	4.40	5.50	6.60	100	7
	UGE-7.5	7.5	13V @ 1.60A	10		3.30	4.10	5.00	200	20
	UGB-7.5	7.5	13V @ 1.50A	5		3.00	3.75	5.00	100	10
	UGB-10	10	17V @ 1.10A	5		2.30	2.85	3.50	100	14
Fast Recovery	UGF-2.5	2.5	6V @ 2.50A	10		5.00	6.25	8.00	150	8
	UGF-5	5	11V @ 1.80A	10		3.75	4.70	6.00	150	14
	UGD-5	5	11V @ 1.60A	5	500*	3.30	4.10	4.80	80	7
	UGF-7.5	7.5	17V @ 1.20A	10	350†	2.50	3.10	4.00	150	20
	UGD-7.5	7.5	17V @ 1.10A	5		2.25	2.80	3.50	80	10
	UGD-10	10	22V @ 0.85A	5		1.75	2.20	2.50	80	14

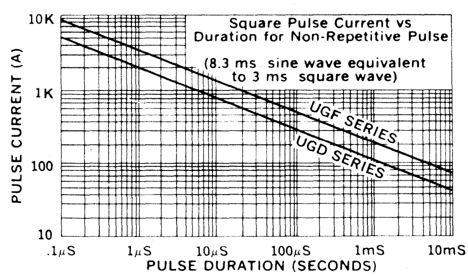
*Measured in a reverse recovery circuit switching from 1.0A forward to 1.0A reverse current recovering to 0.5A.
†Measured in a reverse recovery circuit switching from 0.5A forward to 1.0A reverse current recovering to 0.25A.

**These ratings are based on using "extender plates" that provide additional surface area to radiate heat. Because of possible corona effects caused by scratches on these plates, extreme care is necessary in their handling and they are not recommended where the working voltage exceeds 7.5KV/module. They should be carefully polished prior to installation.

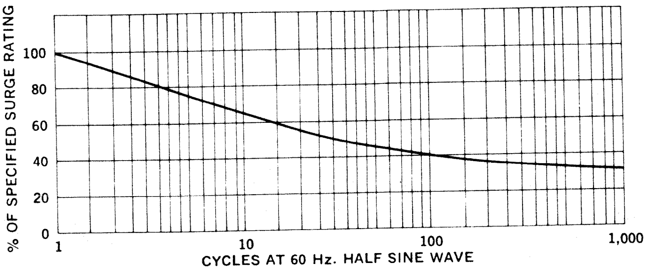
Forward Pulse Current vs. Pulse Duration



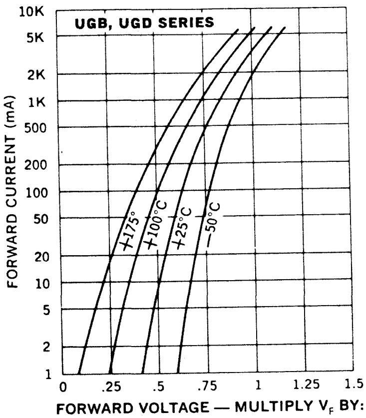
Forward Pulse Current vs. Pulse Duration



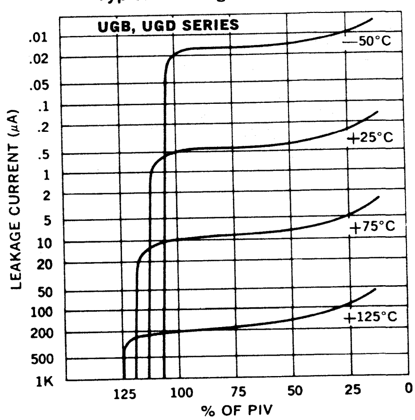
Multiple Surge Rating vs. Duration



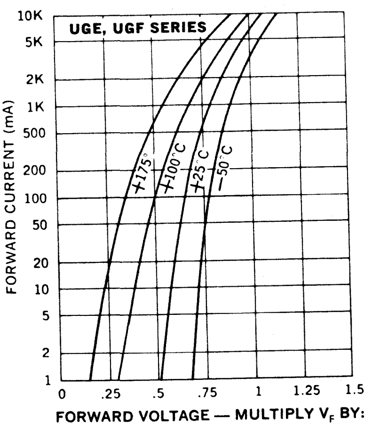
Typical Forward Voltage vs. Forward Current



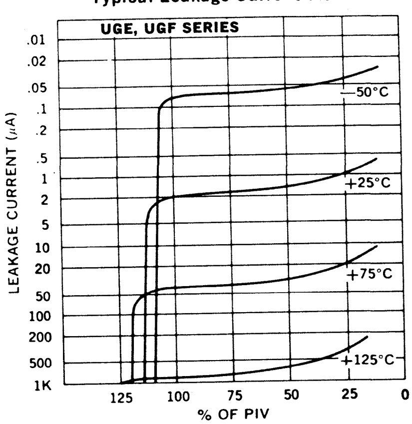
Typical Leakage Current vs. PIV



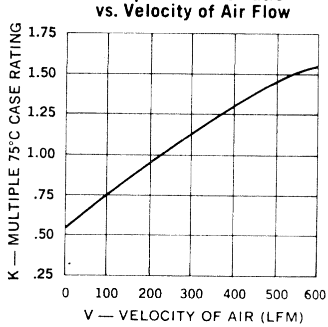
Typical Forward Voltage vs. Forward Current



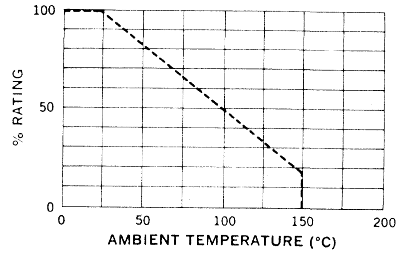
Typical Leakage Current vs. PIV



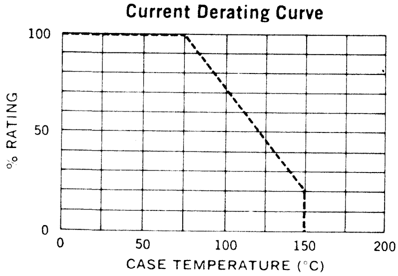
Output Current Ratio vs. Velocity of Air Flow



Current Derating Curve

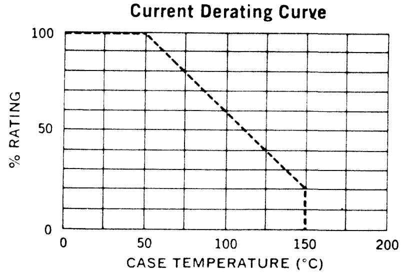


Current Derating Curve



Air Cooled

Current Derating Curve



Oil Immersed

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POWER TRANSISTORS

UMT1008
UMT1009

8 Amp, 500V Fast Switching, High $E_{S/b}$ Silicon NPN Mesa

FEATURES

- Rise Time: 0.4μs } $I_C = 5A$
- Fall Time: 0.4μs }
- High Second Breakdown Energy: 1500μJ
- Collector Emitter Voltage: up to 500V
- Peak Collector Current: 16A
- Key Parameters characterized at 100°C

DESCRIPTION

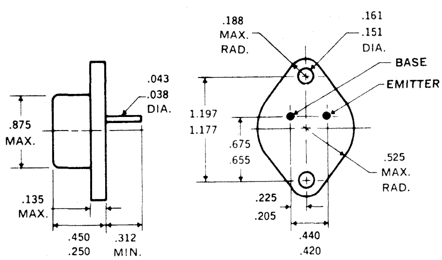
These high voltage triple diffused glass passivated power transistors combine fast switching, low saturation voltage and rugged $E_{S/b}$ capability. They are designed for use in off-line power supplies, high voltage inverters, switching regulators, ignition systems and deflection circuits.

ABSOLUTE MAXIMUM RATINGS

	UMT1008	UMT1009
Collector Emitter Voltage, V_{CEV}	400V	500V
Collector Emitter Voltage, $V_{CEO(SUS)}$	300V	400V
Emitter Base Voltage, V_{EBO}	7V	7V
Collector Current, I_C continuous	8A	8A
Collector Current, I_C peak	16A	16A
Base Current, I_B continuous	8A	8A
Power Dissipation, 25°C Case	125W	125W
Derating Factor	.714W/°C	.714W/°C
Operating and Storage Temperature Range	—65 to 200°C	

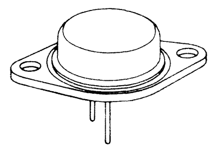
MECHANICAL SPECIFICATIONS

UMT1008 UMT1009



Dimensions in inches.

TO-3



UNITRODE

4/77A

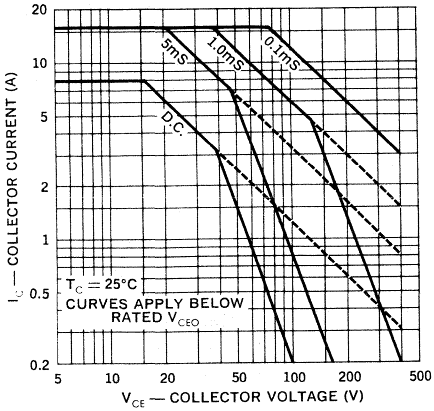
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Test	Symbol	UMT1008 MIN.	UMT1008 MAX.	UMT1009 MIN.	UMT1009 MAX.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	12	60	12	60		$I_C = 2.5A, V_{CE} = 3V$
D.C. Current Gain (Note 1)	h_{FE}	7	35	7	35		$I_C = 5.0A, V_{CE} = 3V$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	1.5	—	1.5	V	$I_C = 5.0A, I_B = 1.0A$
Collector Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{CE(sat)}$	—	2.5	—	2.5	V	$I_C = 5.0A, I_B = 1.0A$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	5.0	—	5.0	V	$I_C = 8.0A, I_B = 2.0A$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	1.6	—	1.6	V	$I_C = 5.0A, I_B = 1.0A$
Base Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{BE(sat)}$	—	1.6	—	1.6	V	$I_C = 5.0A, I_B = 1.0A$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO(sus)}$	300	—	400	—	V	$I_C = 0.1A$
Collector-Emitter Sustaining Voltage $T_C = 100°C$ (Note 2)	$V_{CEX(sus)}$	350	—	450	—	V	$I_C = 5.0A, L = 180\mu H$ $I_{B1} = I_{B2} = 1A$ V_{CE} clamp = rated $V_{CEX(SUS)}$
Emitter-Base Cutoff Current	I_{EBO}	—	1	—	1	mA	$V_{EB} = 9V$
Collector Cutoff Current	I_{CEV}	— —	0.5 —	— —	— 0.5	mA	$V_{CE} = 400V, V_{BE} = -1.5V$ $V_{CE} = 500V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CEV}	— —	2.5 —	— —	— 2.5	mA	$V_{CE} = 400V, V_{BE} = -1.5V$ $V_{CE} = 500V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CER}	— —	3.0 —	— —	— 3.0	mA	$V_{CE} = 400V, R_{BE} = 50\Omega$ $V_{CE} = 500V, R_{BE} = 50\Omega$
Output Capacitance, Common Base	C_{obo}	100	200	100	200	pF	$V_{CB} = 10V, f = 1 MHz$
Gain-Bandwidth Product	F_T	6	30	6	30	MHz	$V_{CE} = 10V, I_C = 0.3A, f = 1 MHz$
Energy Second Breakdown (unclamped)	$E_{s/b}$	1500	—	1500	—	μJ	$I_C = 5.0A$ $I_{B1} = 1A$ $L = 120\mu H$ unclamped
Resistive Switching Speeds Delay Time Rise Time Storage Time Fall Time	 t_d t_r t_s t_f	 — — — —	 0.1 0.4 4.0 0.4	 — — — —	 0.1 0.4 4.0 0.4	μs	$I_C = 5.0A$ $V_{CC} = 200V$ $I_{B1} = I_{B2} = 1.0A$ $V_{BE(off)} = 5V$
Inductive Switching Speeds $T_C = 100°C$ Storage Time Fall Time	 t_s t_f	 — —	 4.0 0.4	 — —	 4.0 0.4	μs	$I_C = 5.0A, L = 180\mu H$ $I_{B1} = I_{B2} = 1A$ V_{CE} clamp = rated $V_{CEX(SUS)}$
Thermal Resistance, Junction-to-Case	$R_{\Theta JC}$	—	1.4	—	1.4	°C/W	

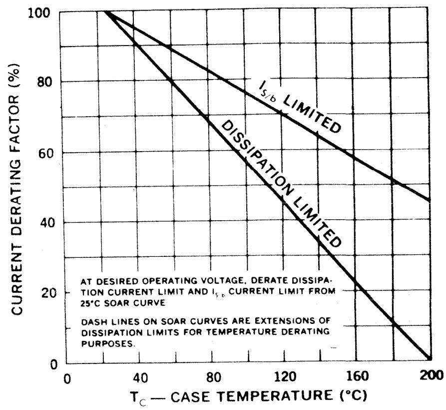
Notes

1. Pulse length = 250 μs; duty cycle $\leqslant$1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length $\cong$ 50 μs; duty cycle $\leqslant$1%. Voltage clamped at maximum collector-emitter voltage.

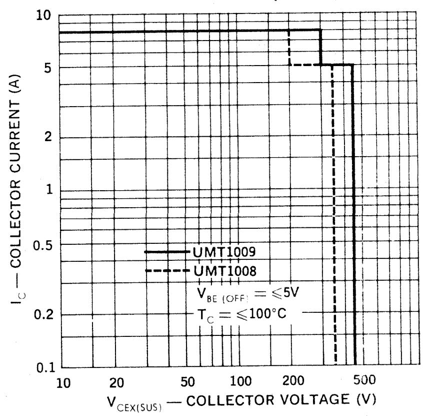
Forward Bias Safe Operating Area



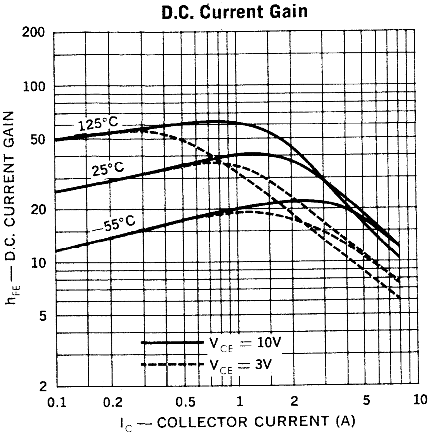
Power Derating



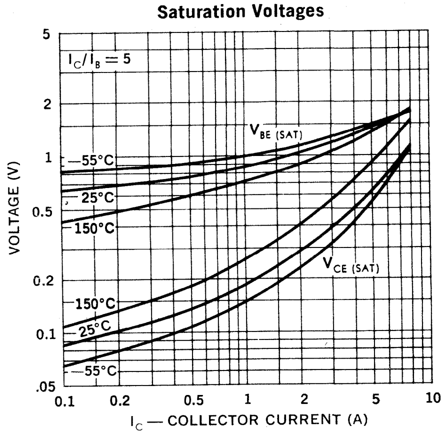
Reverse Biased Safe Operating Area



D.C. Current Gain



Saturation Voltages



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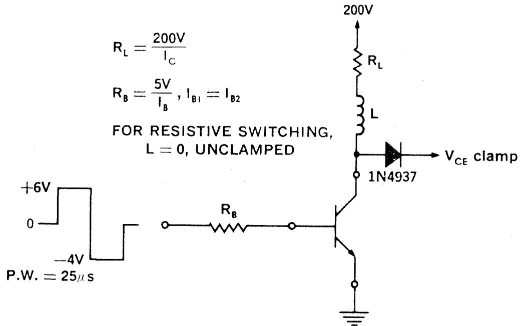
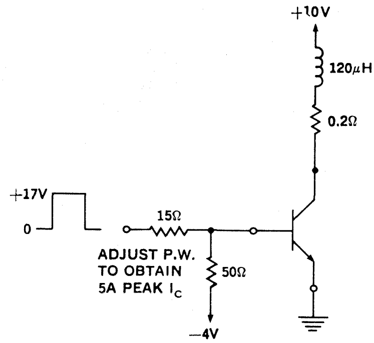
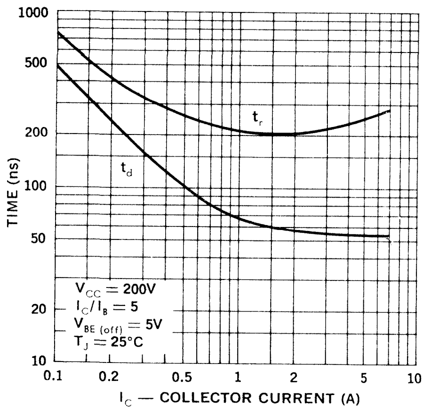
Switching Time, $V_{CEX(sus)}$ Test Circuit



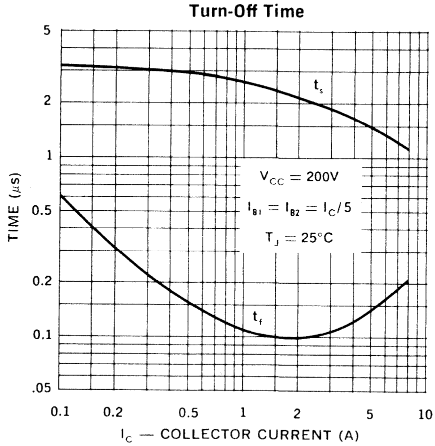
$E_{S/b}$ Test Circuit



Turn-On Time



Turn-Off Time



POWER TRANSISTORS

UMT1203
UMT1204

3 Amp, 500V, Fast Switching Silicon NPN Mesa

FEATURES

- Collector Emitter Voltage: up to 500V
- Peak Collector Current: 5A
- Rise Time: $\leqslant 1.0\mu s$ } at $I_C = 2A$
- Fall Time: $\leqslant 0.7\mu s$ } at $I_C = 2A$
- Key Parameters characterized at 100°C
- Economical Plastic Molded Construction

DESCRIPTION

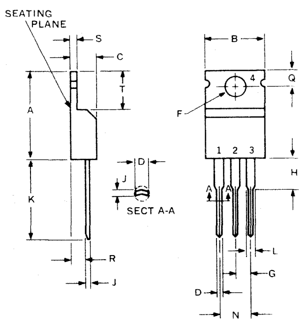
These high voltage triple diffused glass passivated power transistors, in a plastic TO-220AB package, combine fast switching, low saturation voltage and rugged $E_{s/b}$ capability. They are designed for use in off-line power supplies, high voltage inverters, switching regulators, deflection circuits, motor controls and solenoid/relay drivers.

ABSOLUTE MAXIMUM RATINGS

	UMT1203	UMT1204
Collector Emitter Voltage, V_{CEV}	400V	500V
Collector Emitter Voltage, $V_{CEO\,(SUS)}$	300V	400V
Emitter Base Voltage, V_{EBO}	7V	7V
Collector Current, I_C continuous	3A	3A
Collector Current, I_{CM} peak	5A	5A
Base Current, I_B continuous	1A	1A
Power Dissipation, 25°C Case	40W	40W
Derating Factor	0.32W/°C	0.32W/°C
Operating and Storage Temperature Range	—65 to 150°C	

MECHANICAL SPECIFICATIONS

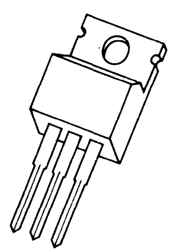
UMT1203; UMT1204



PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.23	15.87	0.560	0.625
B	9.66	10.66	0.380	0.420
C	3.56	4.82	0.140	0.190
D	0.51	1.14	0.020	0.045
F	3.531	3.733	0.139	0.147
G	2.29	2.79	0.090	0.110
H		6.35	—	0.250
J	0.38	0.64	0.015	0.025
K	12.70	14.27	0.500	0.562
L	1.14	1.77	0.045	0.070
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.92	0.080	0.115
S	1.14	1.39	0.045	0.055
T	5.85	6.85	0.230	0.270

TO-220AB



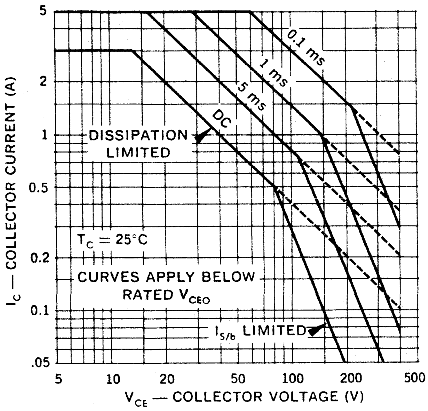
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

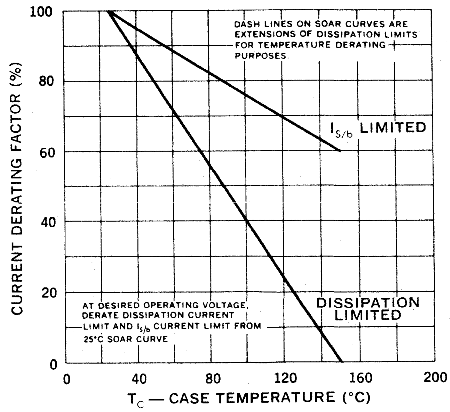
Test	Symbol	UMT1203 MIN.	UMT1203 MAX.	UMT1204 MIN.	UMT1204 MAX.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	12	60	12	60		$I_C = 1.0A, V_{CE} = 3V$
D.C. Current Gain (Note 1)	h_{FE}	7	35	7	35		$I_C = 2.0A, V_{CE} = 3V$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	1.2	—	1.2	V	$I_C = 2.0A, I_B = 0.4A$
Collector Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{CE(sat)}$	—	1.5	—	1.5	V	$I_C = 2.0A, I_B = 0.4A$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	3.0	—	3.0	V	$I_C = 3.0A, I_B = 0.75A$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	1.3	—	1.3	V	$I_C = 2.0A, I_B = 0.4A$
Base Saturation Voltage, $T_C = 100°C$ (Note 1)	$V_{BE(sat)}$	—	1.5	—	1.5	V	$I_C = 2.0A, I_B = 0.4A$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO(sus)}$	300	—	400	—	V	$I_C = 0.1A$
Collector-Emitter Sustaining Voltage $T_C = 100°C$ (Note 2)	$V_{CEX(sus)}$	350	—	450	—	V	$I_C = 2.0A, L = 500\mu H$ $I_{B1} = I_{B2} = 0.4A$ V_{CE} clamp = rated $V_{CEX(sus)}$
Emitter-Base Cutoff Current	I_{EBO}	—	1	—	1	mA	$V_{EB} = 7V$
Collector Cutoff Current	I_{CEV}	—	0.5	—	—	mA	$V_{CE} = 400V, V_{BE} = -1.5V$
		—	—	—	0.5		$V_{CE} = 500V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CEV}	—	2.5	—	—	mA	$V_{CE} = 400V, V_{BE} = -1.5V$
		—	—	—	2.5		$V_{CE} = 500V, V_{BE} = -1.5V$
Collector Cutoff Current, $T_C = 100°C$	I_{CER}	—	3.0	—	—	mA	$V_{CE} = 400V, R = 50\Omega$
		—	—	—	3.0		$V_{CE} = 500V, R = 50\Omega$
Output Capacitance, Common Base	C_{obo}	35	100	35	100	pF	$V_{CB} = 10V, f = 1 MHz$
Gain-Bandwidth Product	F_T	6	30	6	30	MHz	$V_{CE} = 10V, I_C = 0.3A, f = 1 MHz$
Energy Second Breakdown (unclamped)	$E_{S/b}$	80	—	80	—	μJ	$I_C = 2.0A$ $I_{B1} = 0.4A$ $L = 40\mu H$ unclamped
Resistive Switching Speeds						μs	$I_C = 2.0A$ $V_{CC} = 200V$ $I_{B1} = I_{B2} = 0.4A$ $V_{BE(off)} = 5V$
Delay Time	t_d	—	0.1	—	0.1		
Rise Time	t_r	—	1.0	—	1.0		
Storage Time	t_s	—	4.0	—	4.0		
Fall Time	t_f	—	0.7	—	0.7		
Inductive Switching Speeds $T_C = 100°C$						μs	$I_C = 2.0A, L = 500\mu H$ $I_{B1} = I_{B2} = 0.4A$ V_{CE} clamp = rated $V_{CEX(sus)}$
Storage Time	t_s	—	4.0	—	4.0		
Fall Time	t_f	—	0.9	—	0.9		
Thermal Resistance, Junction-to-Case	$R_{\Theta JC}$	—	3.12	—	3.12	°C/W	

Notes
1. Pulse length = 250 μs; duty cycle ≤1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ≤1%. Voltage clamped at maximum collector-emitter voltage.

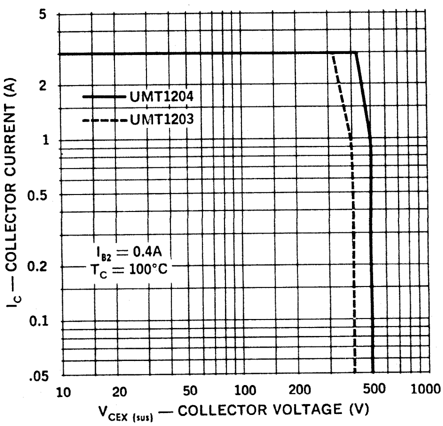
Forward Bias Safe Operating Area



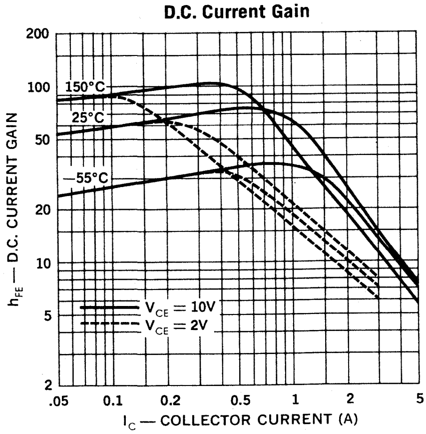
Power Derating



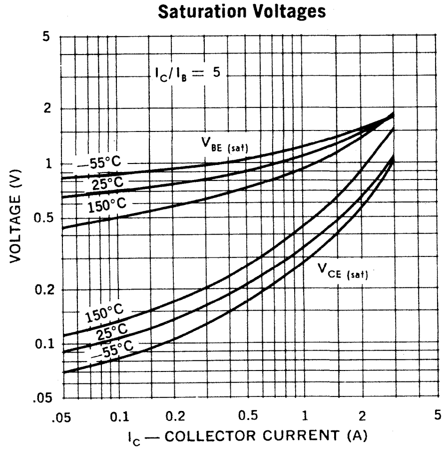
Reverse Biased Safe Operating Area



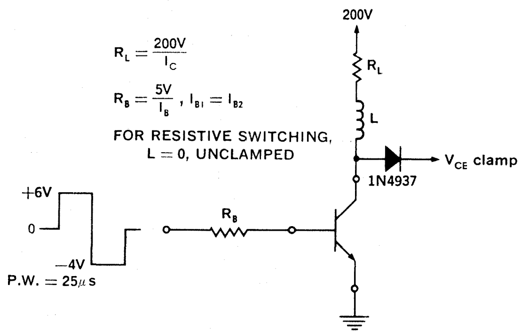
D.C. Current Gain



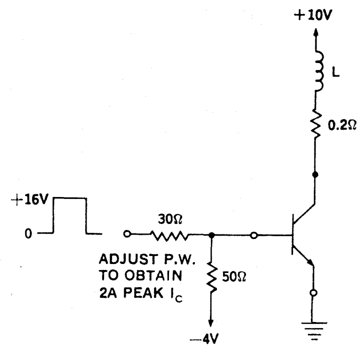
Saturation Voltages



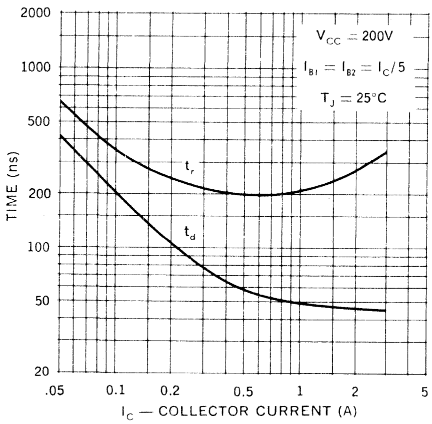
Switching Time, $V_{CEX (sus)}$ Test Circuit



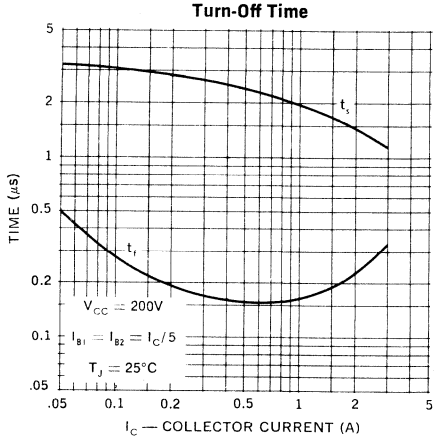
$E_{S/b}$ Test Circuit



Turn-On Time



Turn-Off Time



POWER TRANSISTORS

2 Amp, 500V, Fast Switching Silicon NPN Mesa

UMT3584
UMT3585

FEATURES

- Collector Base Voltage: up to 500V
- Peak Collector Current: 5A
- Rise Time $\leqslant 3\mu s$ } $I_C = 1A$
- Fall Time $\leqslant 3\mu s$ }
- Economical Plastic Molded Construction

DESCRIPTION

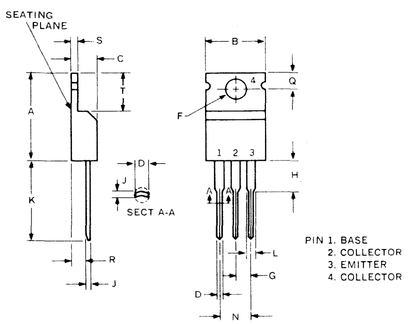
These high voltage triple diffused glass passivated power transistors in a plastic TO-220AB package combine fast switching, low saturation voltage and rugged $E_{s/b}$ capability. They are designed for use in off-line switching regulators, converters, inverters and deflection circuitry.

ABSOLUTE MAXIMUM RATINGS

	UMT3584	UMT3585
Collector Base Voltage, V_{CBO}	375V	500V
Collector Emitter Voltage, $V_{CEO(SUS)}$	250V	300V
Emitter Base Voltage, V_{EBO}	6V	6V
Collector Current, I_C continuous	2A	2A
I_{CM} peak	5A	5A
D.C. Base Current, continuous	1A	1A
Power Dissipation, P_T 25°C Case	35W	35W
Operating and Storage Temperature Range	−65 to +150°C	

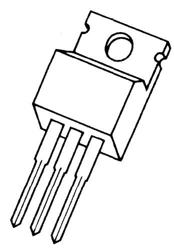
MECHANICAL SPECIFICATIONS

UMT3584, UMT3585



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	14.23	15.87	0.560	0.625
B	9.66	10.66	0.380	0.420
C	3.56	4.82	0.140	0.190
D	0.51	1.14	0.020	0.045
F	3.531	3.733	0.139	0.147
G	2.29	2.79	0.090	0.110
H		6.35	—	0.250
J	0.38	0.64	0.015	0.025
K	12.70	14.27	0.500	0.562
L	1.14	1.77	0.045	0.070
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.92	0.080	0.115
S	1.14	1.39	0.045	0.055
T	5.85	6.85	0.230	0.270

TO-220AB



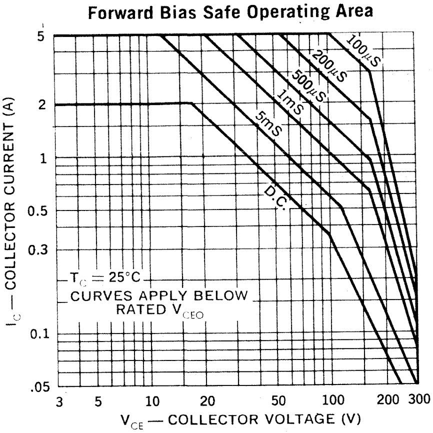
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

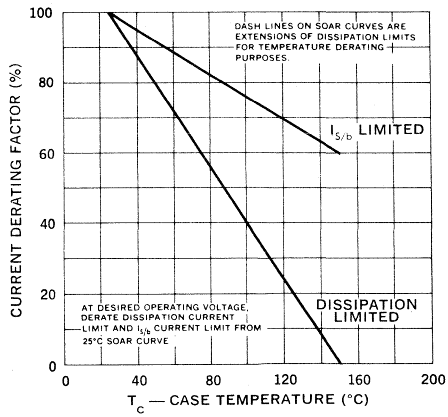
Test	Symbol	UMT3584 MIN.	UMT3584 MAX.	UMT3585 MIN.	UMT3585 MAX.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	40 8 25	— 80 100	40 8 25	— 80 100		$I_C = 100mA, V_{CE} = 10V$ $I_C = 1A, V_{CE} = 2V$ $I_C = 1A, V_{CE} = 10V$
Collector Saturation Voltage (Note 1)	$V_{CE(sat)}$	—	0.75	—	0.75	V	$I_C = 1A, I_B = 125mA$
Base Saturation Voltage (Note 1)	$V_{BE(sat)}$	—	1.4	—	1.4	V	$I_C = 1A, I_B = 100mA$
Collector-Emitter Sustaining Voltage (Note 2)	$V_{CEO(sus)}$	250	—	300	—	V	$I_C = 200mA$
Collector-Emitter Sustaining Voltage (See Note 2)	$V_{CER(sus)}$	300	—	400	—	V	$I_C = 200mA$ $R_{BE} = 200\Omega$
Emitter Cutoff Current	I_{EBO}	—	0.5	—	0.5	mA	$V_{BE} = -6V$
Collector-Cutoff Current	I_{CEO}	—	5.0	—	5.0	mA	$V_{CE} = 150V$
Collector-Cutoff Current	I_{CEV}	— —	1.0 —	— —	— 1.0	mA	$V_{CE} = 340V, V_{BE} = -1.5V$ $V_{CE} = 450V, V_{BE} = -1.5V$
Collector Cutoff Current, 150°C	I_{CEV}	—	3.0	—	3.0	mA	$V_{CE} = 300V, V_{BE} = -1.5V$
Small Signal Forward Transfer Ratio	h_{fe}	3	—	3	—	—	$I_C = 200mA, V_{CE} = 10V$ $f = 5$ MHz
Collector Capacitance	C_{ob}	—	120	—	120	pF	$V_{CB} = 10V, f = 1$ MHz
Second Breakdown Collector Current	$I_{s/b}$	350	—	350	—	mA	$V_{CE} = 100V$
Second Breakdown Energy	$E_{s/b}$	200	—	200	—	μJ	$I_C = 2A$ $R_{BE} = 20\Omega$ $L = 100\mu H$
Switching Speeds Rise Time Storage Time Fall Time	 t_r t_s t_f	 — — —	 3.0 4.0 3.0	 — — —	 3.0 4.0 3.0	μs	$I_C = 1A$ $I_{B1} = I_{B2} = 100mA$ $V_{CC} = 200V$
Thermal Resistance: Junction-to-Case	$R_{\Theta JC}$	—	3.57	—	3.57	°C/W	
Junction-to-Ambient	$R_{\Theta JA}$	—	70	—	70	°C/W	

Notes
1. Pulse length = 250 μs; duty cycle ⩽1%.
2. Sustaining Voltage. Measured at a high current point where collector-emitter voltage is lowest. Current pulse length ≅ 50 μs; duty cycle ⩽1%. Voltage clamped at maximum collector-emitter voltage.

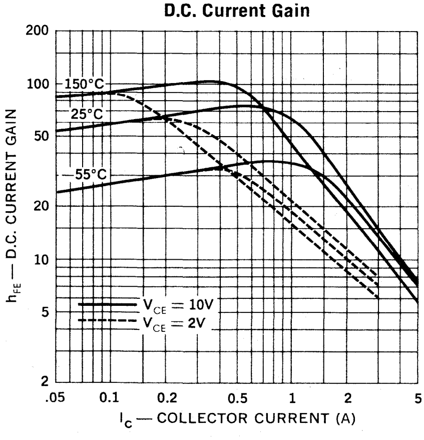
Forward Bias Safe Operating Area



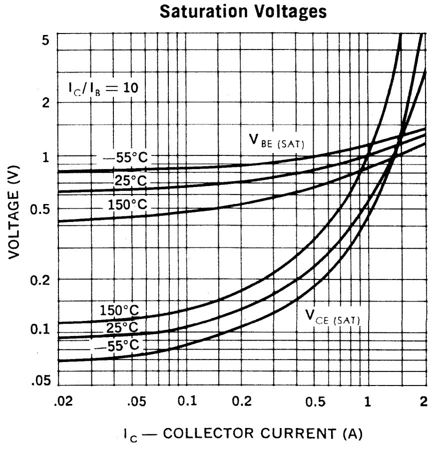
Power Derating



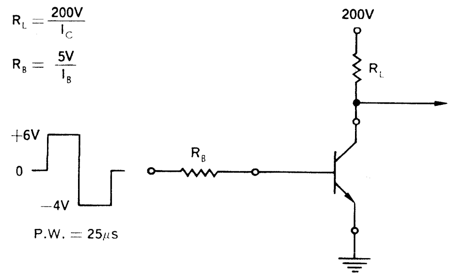
D.C. Current Gain



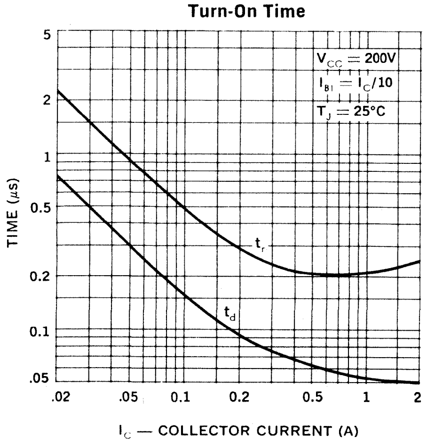
Saturation Voltages



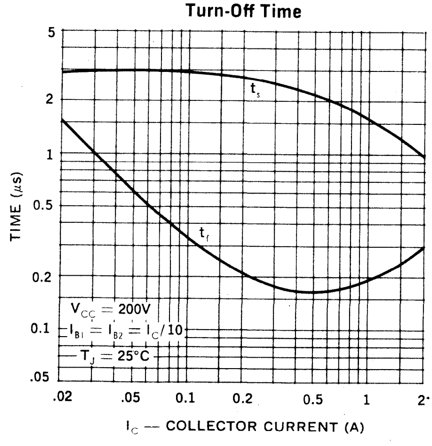
Switching Time Test Circuit



Turn-On Time



Turn-Off Time



POWER TRANSISTORS
0.5 Amp, 400V, Planar NPN

UPT011 UPT012 UPT013 UPT014 UPT015
UPT021 UPT022 UPT023 UPT024 UPT025

FEATURES
- Collector-Base Voltage: up to 400V
- Peak Collector Current: 1A
- Turn-on Time: 50ns
- Turn-off Time: 400ns

DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

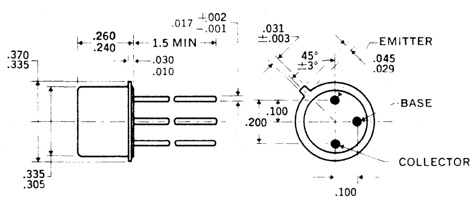
ABSOLUTE MAXIMUM RATINGS

	UPT011 UPT021	UPT012 UPT022	UPT013 UPT023	UPT014 UPT024	UPT015 UPT025
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	0.5A	0.5A	0.5A	0.5A	0.5A
Peak Collector Current, I_C	1A	1A	1A	1A	1A
Base Current, I_B	0.2A	0.2A	0.2A	0.2A	0.2A

	UPT011-015	UPT021-025
Power Dissipation		
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

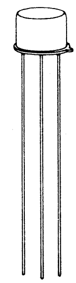
MECHANICAL SPECIFICATIONS

UPT011 UPT012 UPT013 UPT014 UPT015

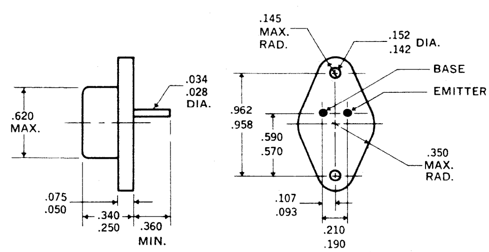


Dimensions in inches.

TO-5

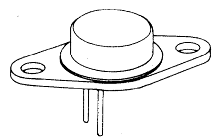


UPT021 UPT022 UPT023 UPT024 UPT025



Dimensions in inches.

TO-66



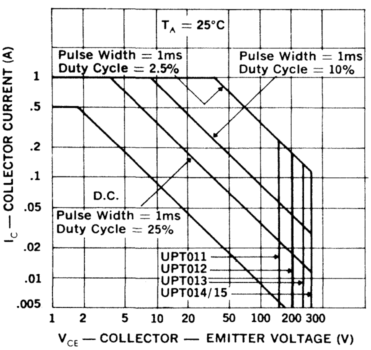
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

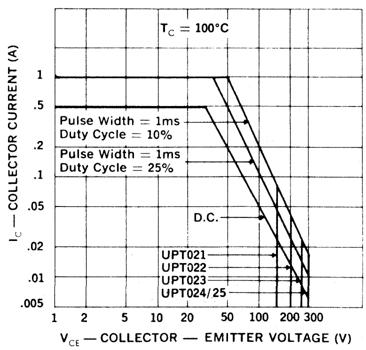
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.1A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 0.5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5 Typ.		—	$I_C = 1A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 0.5A$, $I_B = 0.1A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 0.5A$, $I_B = 0.1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT011, UPT021		200	—		
UPT012, UPT022		250	—		
UPT013, UPT023		300	—		
UPT014, UPT024		350	—		
UPT015 UPT025		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT011, UPT021		150	—		
UPT012, UPT022		200	—		
UPT013, UPT023		250	—		
UPT014-5, UPT024-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	20	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds: Turn-on Time	t_{on}	50 Typ.		ns	$I_C = 0.5A$
Switching Speeds: Turn-off Time	t_{off}	400 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

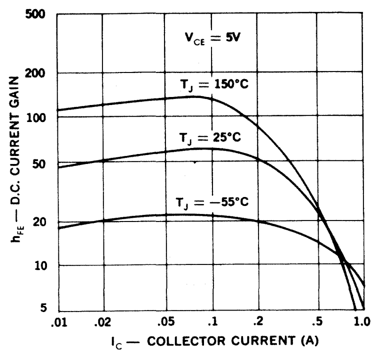
Maximum Safe Operating Area
UPT011-015



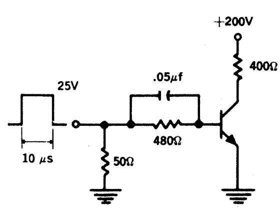
Maximum Safe Operating Area
UPT021-025



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

1 Amp, 150V, Planar NPN

UPT111
UPT112
UPT113
UPT114
UPT115

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 2A
- Turn-on Time: 100ns
- Turn-off Time: 250ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

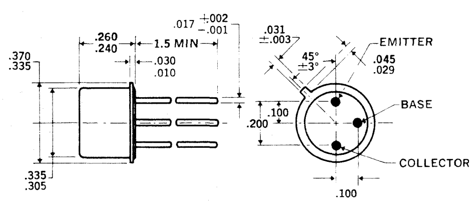
ABSOLUTE MAXIMUM RATINGS

	UPT111	UPT112	UPT113	UPT114	UPT115
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	1A	1A	1A	1A	1A
Peak Collector Current, I_C	2A	2A	2A	2A	2A
Base Current, I_B	0.5A	0.5A	0.5A	0.5A	0.5A

	UPT111-115	UPT121-125
Power Dissipation		
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, Θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

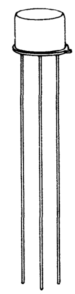
MECHANICAL SPECIFICATIONS

UPT111 UPT112 UPT113 UPT114 UPT115



Dimensions in inches.

TO-5



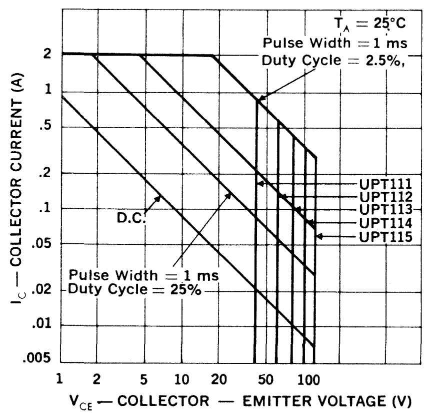
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

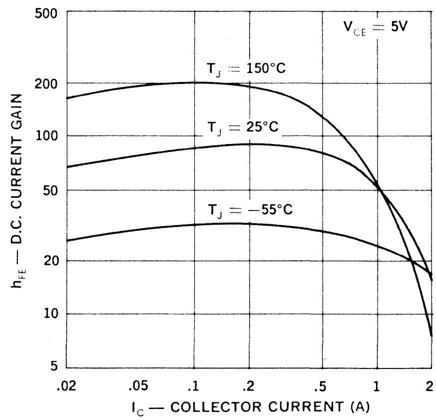
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 1A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15 Typ.		—	$I_C = 2A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 1A, I_B = 0.1A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.2	Vdc	$I_C = 1A, I_B = 0.1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT111		60	—		
UPT112		80	—		
UPT113		100	—		
UPT114		120	—		
UPT115		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT111		40	—		
UPT112		60	—		
UPT113		80	—		
UPT114-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	40	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	50 Typ.		MHz	$I_C = 0.1Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	100 Typ.		ns	$I_C = 1A$
Switching Speeds — Turn-off Time	t_{off}	250 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

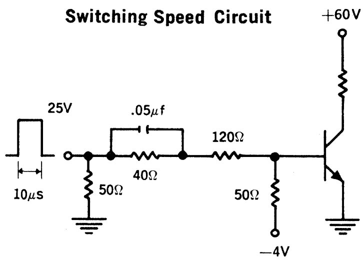
Maximum Safe Operating Area UPT111 - 115



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

2 Amp, 150V, Planar NPN

UPT211 UPT212 UPT213 UPT214 UPT215
UPT221 UPT222 UPT223 UPT224 UPT225

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 5A
- Turn-on Time: 130ns
- Turn-off Time: 300ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

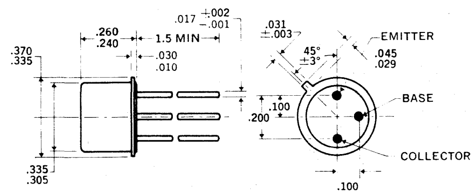
ABSOLUTE MAXIMUM RATINGS

	UPT211 UPT221	UPT212 UPT222	UPT213 UPT223	UPT214 UPT224	UPT215 UPT225
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	2A	2A	2A	2A	2A
Peak Collector Current, I_C	5A	5A	5A	5A	5A
Base Current, I_B	1A	1A	1A	1A	1A

	UPT211-215	UPT221-225
Power Dissipation		
25°C Ambient	.85W	1.6W
100°C Case	4W	16W
Thermal Resistance, Θ_{J-C}	25°C/W	6.7°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

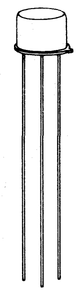
MECHANICAL SPECIFICATIONS

UPT211 UPT212 UPT213 UPT214 UPT215

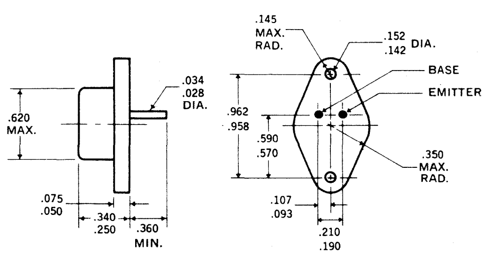


Dimensions in inches.

TO-5

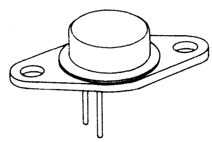


UPT221 UPT222 UPT223 UPT224 UPT225



Dimensions in inches.

TO-66



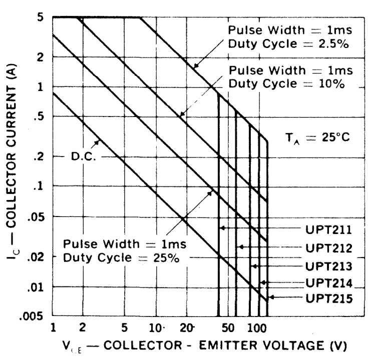
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

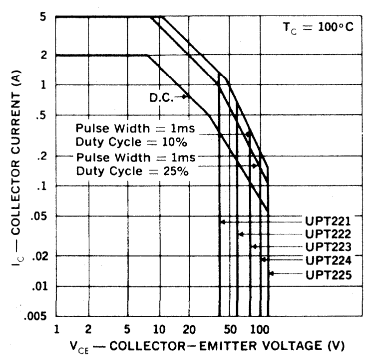
Test		Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)		h_{FE}	30	—	—	$I_C = 0.5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	20	—	—	$I_C = 2A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)		h_{FE}	10 Typ.		—	$I_C = 5A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)		V_{CE} (sat)	—	1.0	Vdc	$I_C = 2A$, $I_B = 0.2A$
Base Saturation Voltage (Note 1)		V_{BE} (sat)	—	1.2	Vdc	$I_C = 2A$, $I_B = 0.2A$
Collector-Emitter Breakdown Voltage (Note 1)		BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT211, UPT221			60	—		
UPT212, UPT222			80	—		
UPT213, UPT223			100	—		
UPT214, UPT224			120	—		
UPT215, UPT225			150	—		
Collector-Emitter Breakdown Voltage (Note 1)		BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT211, UPT221			40	—		
UPT212, UPT222			60	—		
UPT213, UPT223			80	—		
UPT214-5, UPT224-5			100	—		
Collector-Emitter Cutoff Current		I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C		I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current		I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance		C_{ob}	—	40	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product		f_T	70 Typ.		MHz	$I_C = 0.1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds	Turn-on Time	t_{on}	130 Typ.		ns	$I_C = 2A$
	Turn-off Time	t_{off}	300 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

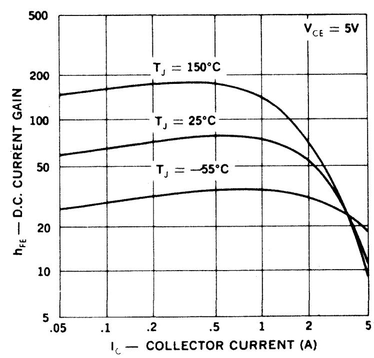
Maximum Safe Operating Area UPT211–215



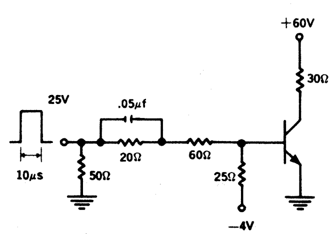
Maximum Safe Operating Area UPT221–225



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS
2 Amp, 400V, Planar NPN

UPT311 UPT321
UPT312 UPT322
UPT313 UPT323
UPT314 UPT324
UPT315 UPT325

FEATURES
- Collector-Base Voltage: up to 400V
- Peak Collector Current: 3A
- Turn-on Time: 200 ns
- Turn-off Time: 800 ns

DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

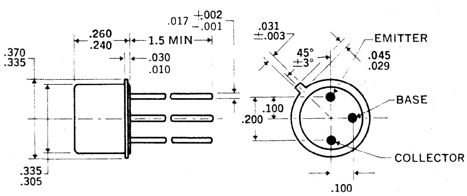
ABSOLUTE MAXIMUM RATINGS

	UPT311 UPT321	UPT312 UPT322	UPT313 UPT323	UPT314 UPT324	UPT315 UPT325
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	2A	2A	2A	2A	2A
Peak Collector Current, I_C	3A	3A	3A	3A	3A
Base Current, I_B	1A	1A	1A	1A	1A

Power Dissipation	UPT311-315	UPT321-325
25°C Ambient	1W	2W
100°C Case	10W	16W
Thermal Resistance, Θ_{J-C}	10°C/W	6.7°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

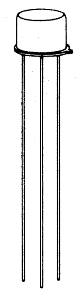
MECHANICAL SPECIFICATIONS

UPT311 UPT312 UPT313 UPT314 UPT315

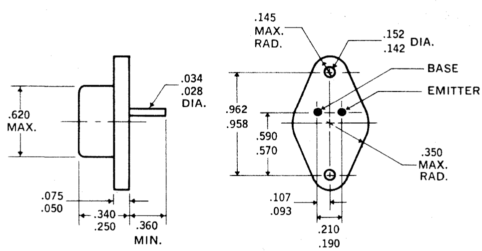


Dimensions in inches.

TO-5

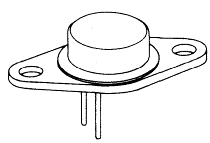


UPT321 UPT322 UPT323 UPT324 UPT325



Dimensions in inches.

TO-66



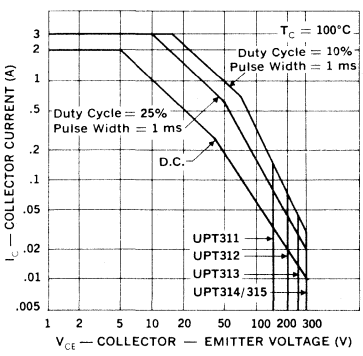
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

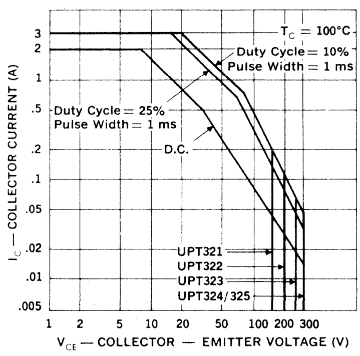
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 0.5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 2A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 3A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 2A$, $I_B = 0.4A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 2A$, $I_B = 0.4A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT311, UPT321		200	—		
UPT312, UPT322		250	—		
UPT313, UPT323		300	—		
UPT314, UPT324		350	—		
UPT315, UPT325		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT311, UPT321		150	—		
UPT312, UPT322		200	—		
UPT313, UPT323		250	—		
UPT314-5, UPT324-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	200 Typ.		ns	$I_C = 1A$
Switching Speeds — Turn-off Time	t_{off}	800 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

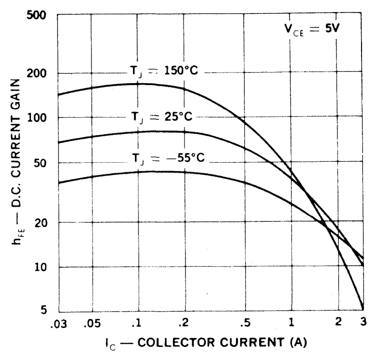
Maximum Safe Operating Area
UPT311 — 315



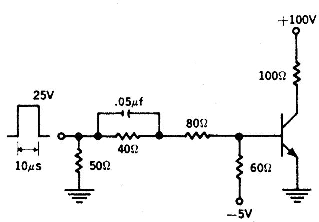
Maximum Safe Operating Area
UPT321 - 325



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

3 Amp, 400V, Planar NPN

UPT521 UPT522 UPT523 UPT524 UPT525
UPT531 UPT532 UPT533 UPT534 UPT535

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 5A
- Turn-on Time: 200ns
- Turn-off Time: 900ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

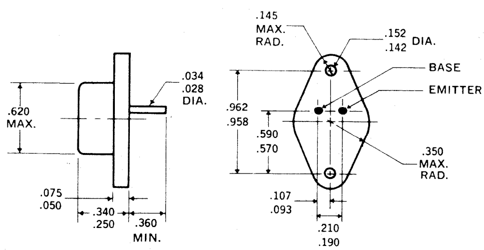
ABSOLUTE MAXIMUM RATINGS

	UPT521 UPT531	UPT522 UPT532	UPT523 UPT533	UPT524 UPT534	UPT525 UPT535
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	3A	3A	3A	3A	3A
Peak Collector Current, I_C	5A	5A	5A	5A	5A
Base Current, I_B	2A	2A	2A	2A	2A

Power Dissipation	UPT521-525	UPT531-535
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

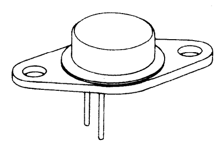
MECHANICAL SPECIFICATIONS

UPT521 UPT522 UPT523 UPT524 UPT525

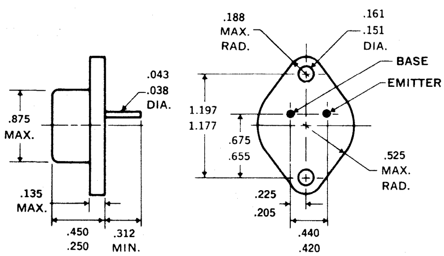


Dimensions in inches.

TO-66

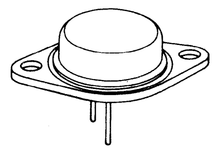


UPT531 UPT532 UPT533 UPT534 UPT535



Dimensions in inches.

TO-3



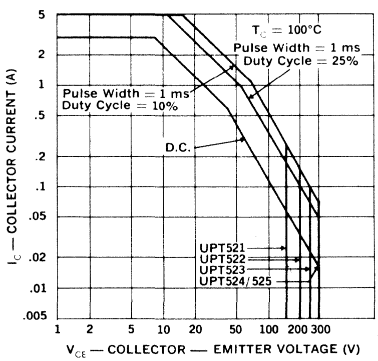
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

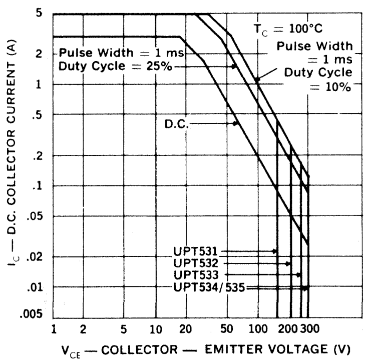
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	25	—	—	$I_C = 1.0A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 3A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 5A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = 3A$, $I_B = 0.6A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 3A$, $I_B = 0.6A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT521, UPT531		200	—		
UPT522, UPT532		250	—		
UPT523, UPT533		300	—		
UPT524, UPT534		350	—		
UPT525, UPT535		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT521, UPT531		150	—		
UPT522, UPT532		200	—		
UPT523, UPT533		250	—		
UPT524-5, UPT534-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, f = 10MHz
Switching Speeds: Turn-on Time	t_{on}	200 Typ.		ns	$I_C = 3A$
Switching Speeds: Turn-off Time	t_{off}	900 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

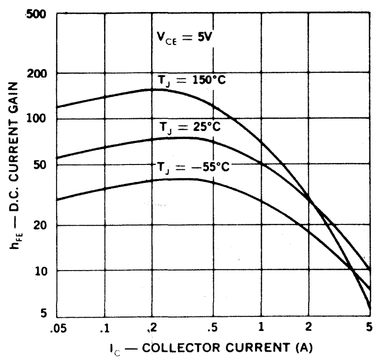
Maximum Safe Operating Area
UPT521 – 525



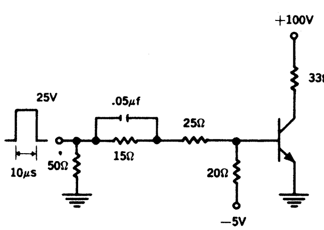
Maximum Safe Operating Area
UPT531 – 535



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

5 Amp, 150V, Planar NPN

UPT611 UPT612 UPT613 UPT614 UPT615

UPT621 UPT622 UPT623 UPT624 UPT625

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 10A
- Turn-on Time: 250ns
- Turn-off Time: 550ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideaıly suited for power supply, pulse amplifier and similar high efficiency power switching applications.

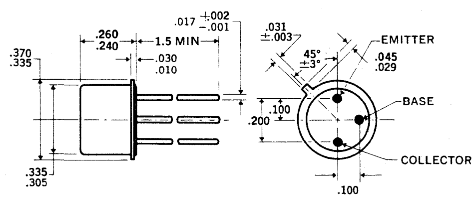
ABSOLUTE MAXIMUM RATINGS

	UPT611 UPT621	UPT612 UPT622	UPT613 UPT623	UPT614 UPT624	UPT615 UPT625
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	5A	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A	10A
Base Current, I_B	2A	2A	2A	2A	2A

Power Dissipation	UPT611-615	UPT621-625
25°C Ambient	1W	2W
100°C Case	5W	20W
Thermal Resistance, Θ_{J-C}	20°C/W	5°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

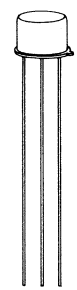
MECHANICAL SPECIFICATIONS

UPT611 UPT612 UPT613 UPT614 UPT615

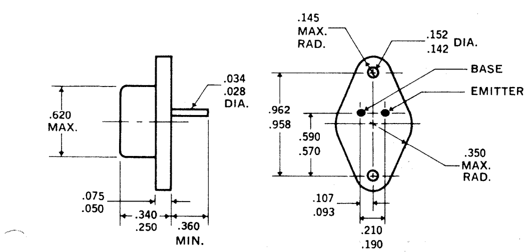


Dimensions in inches.

TO-5

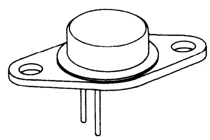


UPT621 UPT622 UPT623 UPT624 UPT625



Dimensions in inches.

TO-66



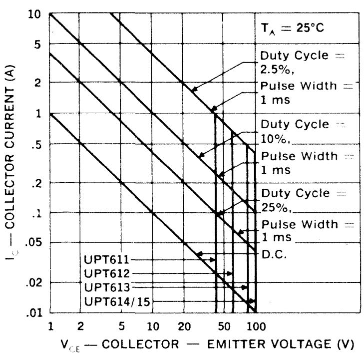
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

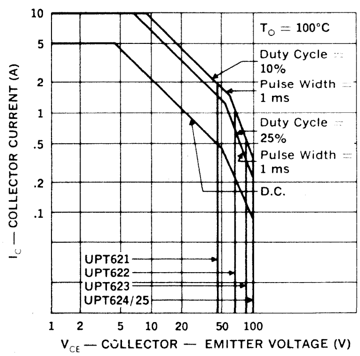
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 1A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	12 Typ.		—	$I_C = 10A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—			$I_C = 5A$, $I_B = 0.5A$
UPT611-3, UPT621-3		—	1.0	Vdc	
UPT614-5, UPT624-5		—	1.5	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—			$I_C = 5A$, $I_B = 0.5A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}		1.5	Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT611, UPT621		60	—	Vdc	
UPT612, UPT622		80	—		
UPT613, UPT623		100	—		
UPT614, UPT624		120	—		
UPT615, UPT625		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT611, UPT621		40	—		
UPT612, UPT622		60	—		
UPT613, UPT623		80	—		
UPT614-5, UPT624-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	40 Typ.		MHz	$I_C = 0.5Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 5A$
Switching Speeds — Turn-off Time	t_{off}	500 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

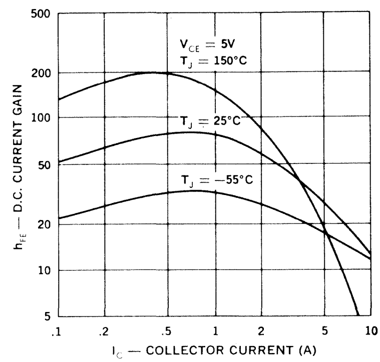
Maximum Safe Operating Area
UPT611 — 615



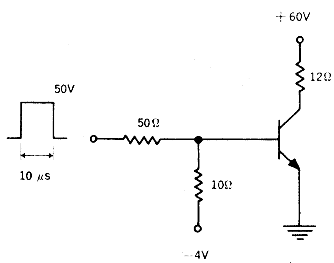
Maximum Safe Operating Area
UPT621 — 625



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

5 Amp, 400V, Planar NPN

UPT721 UPT722 UPT723 UPT724 UPT725
UPT731 UPT732 UPT733 UPT734 UPT735

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 10A
- Turn-on Time: 250ns
- Turn-off Time: 800ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

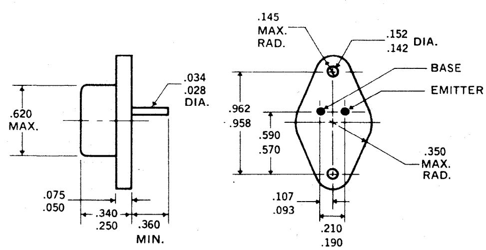
ABSOLUTE MAXIMUM RATINGS

	UPT721 UPT731	UPT722 UPT732	UPT723 UPT733	UPT724 UPT734	UPT725 UPT735
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	5A	5A	5A	5A	5A
Peak Collector Current, I_C	10A	10A	10A	10A	10A
Base Current, I_B	3A	3A	3A	3A	3A

	UPT721-725	UPT731-735
Power Dissipation		
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, Θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

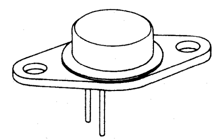
MECHANICAL SPECIFICATIONS

UPT721 UPT722 UPT723 UPT724 UPT725

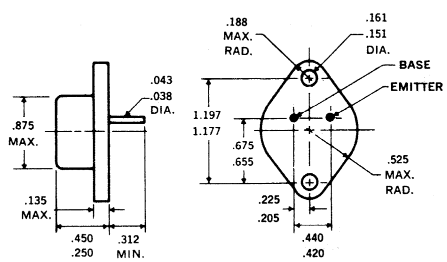


Dimensions in inches.

TO-66

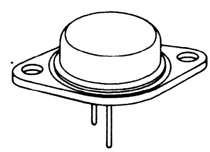


UPT731 UPT732 UPT733 UPT734 UPT735



Dimensions in inches.

TO-3



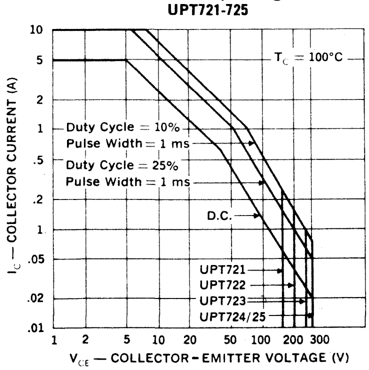
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

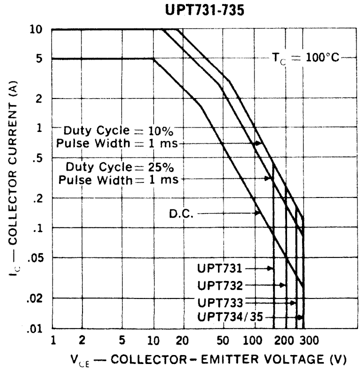
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	25	—	—	$I_C = 1A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 5A, V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5 Typ.		—	$I_C = 10A, V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	$V_{CE}(sat)$	—	1.0	Vdc	$I_C = 5A, I_B = 1A$
Base Saturation Voltage (Note 1)	$V_{BE}(sat)$	—	1.8	Vdc	$I_C = 5A, I_B = 1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc; R_{BE} = 100\Omega$
UPT721, UPT731		200	—		
UPT722, UPT732		250	—		
UPT723, UPT733		300	—		
UPT724, UPT734		350	—		
UPT725, UPT735		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT721, UPT731		150	—		
UPT722, UPT732		200	—		
UPT723, UPT733		250	—		
UPT724-5, UPT734-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	$V_{CE} =$ rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	$V_{CE} =$ rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	120	pf	$V_{CB} = 10Vdc, I_E = 0, f = 1MHz$
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 0.5Adc, V_{CE} = 5Vdc, f = 10MHz$
Switching Speeds Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 5A$
Switching Speeds Turn-off Time	t_{off}	800 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

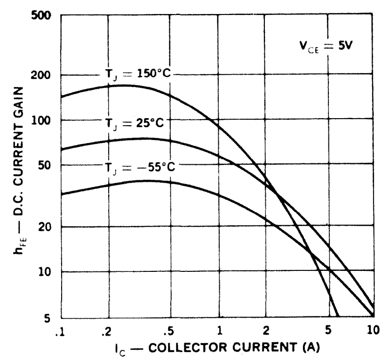
Maximum Safe Operating Area UPT721-725



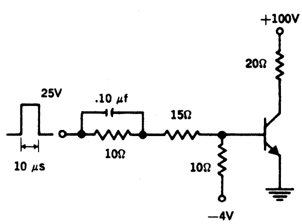
Maximum Safe Operating Area UPT731-735



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS
10 Amp, 150V, Planar NPN

UPT821 UPT822 UPT823 UPT824 UPT825
UPT831 UPT832 UPT833 UPT834 UPT835

FEATURES
- Collector-Base Voltage: up to 150V
- Peak Collector Current: 15A
- Turn-on Time: 250ns
- Turn-off Time: 550ns

DESCRIPTION
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply, pulse amplifier and similar high efficiency power switching applications.

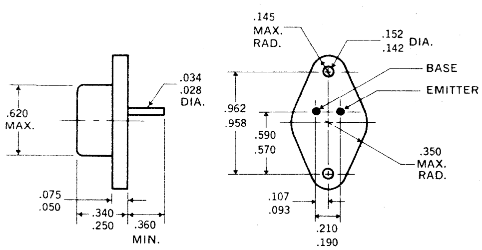
ABSOLUTE MAXIMUM RATINGS

	UPT821 UPT831	UPT822 UPT832	UPT823 UPT833	UPT824 UPT834	UPT825 UPT835
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	10A	10A	10A	10A	10A
Peak Collector Current, I_C	15A	15A	15A	15A	15A
Base Current, I_B	5A	5A	5A	5A	5A

Power Dissipation	UPT821-825	UPT831-835
25°C Ambient	2W	3W
100°C Case	25W	50W
Thermal Resistance, Θ_{J-C}	4°C/W	2°C/W
Operating and Storage Temperature Range	—65°C to 200°C	—65°C to 200°C

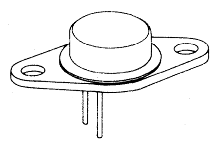
MECHANICAL SPECIFICATIONS

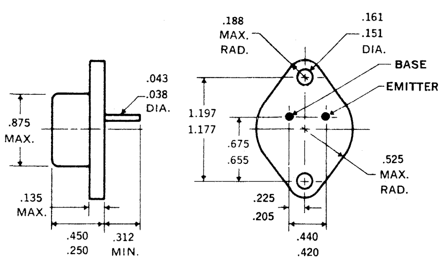
UPT821 UPT822 UPT823 UPT824 UPT825



Dimensions in inches.

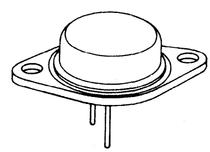
TO-66





Dimensions in inches.

TO-3



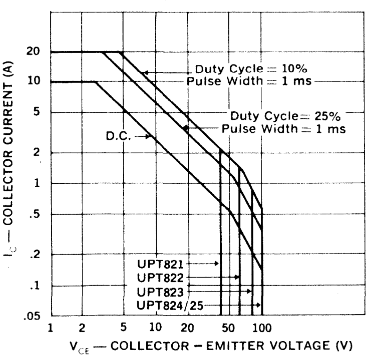
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

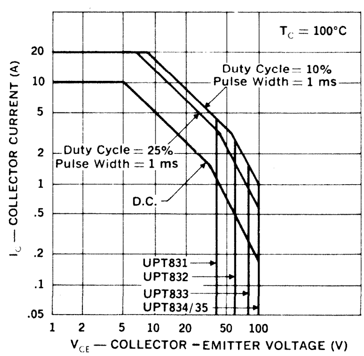
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 10A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15 Typ.		—	$I_C = 15A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—		Vdc	$I_C = 10A$, $I_B = 1A$
UPT821-3, UPT831-5			1.0	Vdc	
UPT824-5, UPT834-5			1.5	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.8	Vdc	$I_C = 10A$, $I_B = 1A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT821, UPT831		60	—		
UPT822, UPT832		80	—		
UPT823, UPT833		100	—		
UPT824, UPT834		120	—		
UPT825, UPT835		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT821, UPT831		40	—		
UPT822, UPT832		60	—		
UPT823, UPT833		80	—		
UPT824-5, UPT834-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	150	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	60 Typ.		MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	250 Typ.		ns	$I_C = 10A$
Switching Speeds — Turn-off Time	t_{off}	550 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

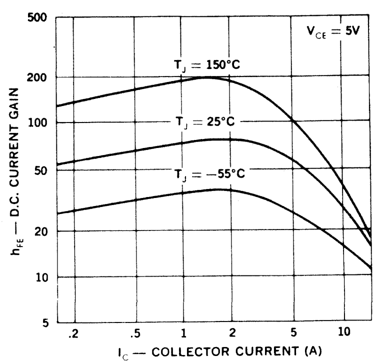
Maximum Safe Operating Area
UPT821 - 825



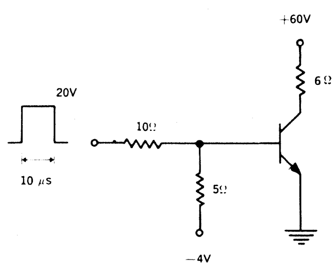
Maximum Safe Operating Area
UPT831 - 835



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS

10 Amp, 400V, Planar NPN

UPT931
UPT932
UPT933
UPT934
UPT935

FEATURES

- Collector-Base Voltage: up to 400V
- Peak Collector Current: 15A
- Turn-on Time: 500ns
- Turn-off Time: 1200ns

DESCRIPTION

Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

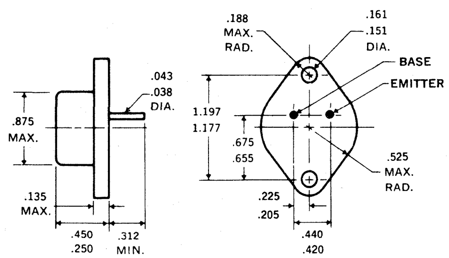
ABSOLUTE MAXIMUM RATINGS

	UPT931	UPT932	UPT933	UPT934	UPT935
Collector-Base Voltage, V_{CBO}	200V	250V	300V	350V	400V
Collector-Emitter Voltage, V_{CEO}	150V	200V	250V	300V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	10A	10A	10A	10A	10A
Peak Collector Current, I_C	15A	15A	15A	15A	15A
Base Current, I_B	5A	5A	5A	5A	5A

	UPT931-935
Power Dissipation	
25°C Ambient	3.5W
100°C Case	70W
Thermal Resistance, Θ_{J-C}	1.43°C/W
Operating and Storage Temperature Range	—65°C to 200°C

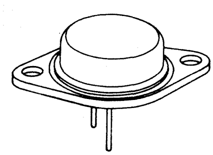
MECHANICAL SPECIFICATIONS

UPT931 UPT932 UPT933 UPT934 UPT935



Dimensions in inches.

TO-3



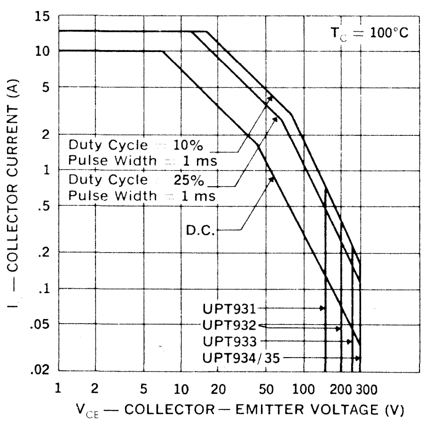
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

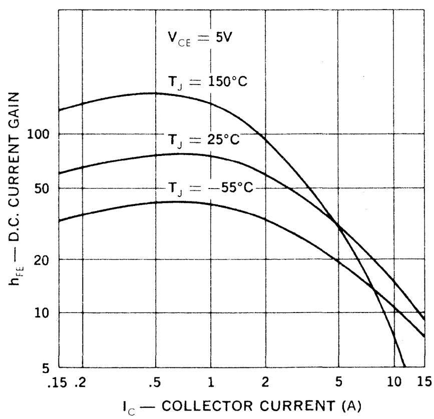
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10	—	—	$I_C = 10A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 15A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	Vdc	$I_C = 10A$, $I_B = 2A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 10A$, $I_B = 2A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT931		200	—		
UPT932		250	—		
UPT933		300	—		
UPT934		350	—		
UPT935		400	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT931		150	—		
UPT932		200	—		
UPT933		250	—		
UPT934-5		300	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Gain-Bandwidth Product	f_T	30 Typ.		MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, f = 10MHz
Switching Speeds: Turn-on Time	t_{on}	500 Typ.		ns	$I_C = 10A$
Switching Speeds: Turn-off Time	t_{off}	1200 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle $\leq$2%.

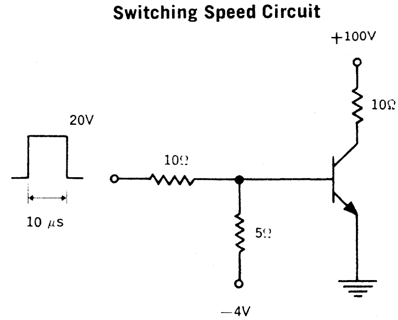
Maximum Safe Operating Area
UPT931—935



D.C. Current Gain
vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS

15 Amp, 150V, Planar NPN

UPT1021 UPT1031
UPT1022 UPT1032
UPT1023 UPT1033
UPT1024 UPT1034
UPT1025 UPT1035

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 20A
- Turn-on Time: 450ns
- Turn-off Time: 350ns

DESCRIPTION

Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

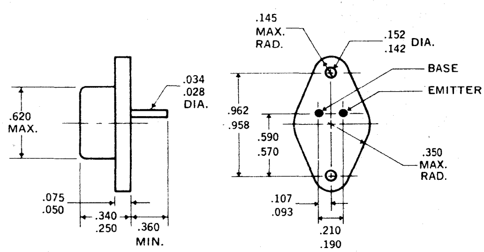
ABSOLUTE MAXIMUM RATINGS

	UPT1021 UPT1031	UPT1022 UPT1032	UPT1023 UPT1033	UPT1024 UPT1034	UPT1025 UPT1035
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	15A	15A	15A	15A	15A
Peak Collector Current, I_C	20A	20A	20A	20A	20A
Base Current, I_B	5A	5A	5A	5A	5A

Power Dissipation	UPT1021-1025	UPT1031-1035
25°C Ambient	2.5W	3.5W
100°C Case	30W	60W
Thermal Resistance, Θ_{J-C}	3.3°C/W	1.65°C/W
Operating and Storage Temperature Range	−65°C to 200°C	−65°C to 200°C

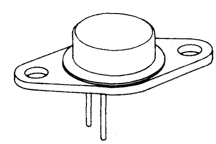
MECHANICAL SPECIFICATIONS

UPT1021 UPT1022 UPT1023 UPT1024 UPT1025

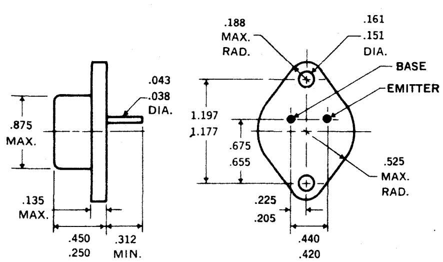


Dimensions in inches.

TO-66

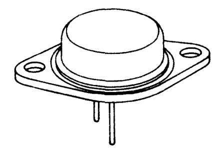


UPT1031 UPT1032 UPT1033 UPT1034 UPT1035



Dimensions in inches.

TO-3



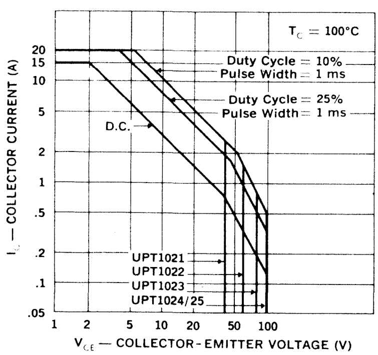
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

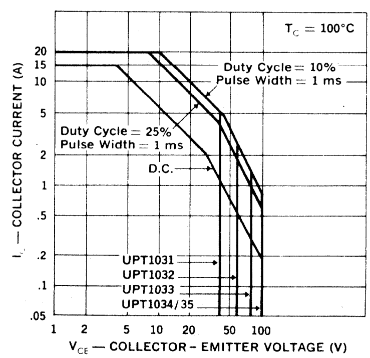
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	40	—	—	$I_C = 5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 15A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 20A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—			$I_C = 15A$, $I_B = 1.5A$
UPT1021-3, UPT1031-3			1.5	Vdc	
UPT1024-5, UPT1034-5			2.0	Vdc	
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 15A$, $I_B = 1.5A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT1021, UPT1031		60	—		
UPT1022, UPT1032		80	—		
UPT1023, UPT1033		100	—		
UPT1024, UPT1034		120	—		
UPT1025, UPT1035		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT1021, UPT1031		40	—		
UPT1022, UPT1032		60	—		
UPT1023, UPT1033		80	—		
UPT1024-5, UPT1034-5		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, T = 150°C
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Gain-Bandwidth Product	f_T	50 Typ.		MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, f = 10MHz
Switching Speeds — Turn-on Time	t_{on}	450 Typ.		ns	$I_C = 15A$
Switching Speeds — Turn-off Time	t_{off}	350 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

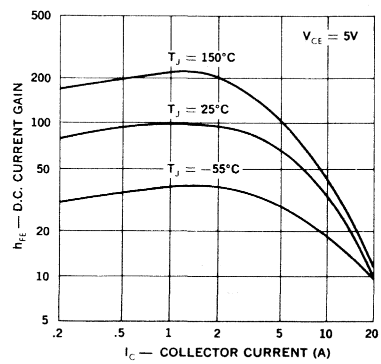
Maximum Safe Operating Area UPT1021–1025



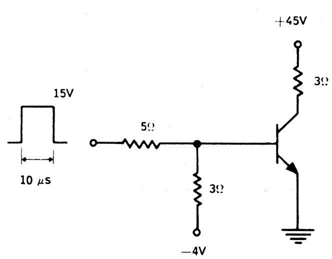
Maximum Safe Operating Area UPT1031–1035



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



POWER TRANSISTORS
20 Amp, 150V, Planar NPN

UPT1131
UPT1132
UPT1133
UPT1134
UPT1135

FEATURES

- Collector-Base Voltage: up to 150V
- Peak Collector Current: 30A
- Turn-on Time: 300ns
- Turn-off Time: 600ns

DESCRIPTION

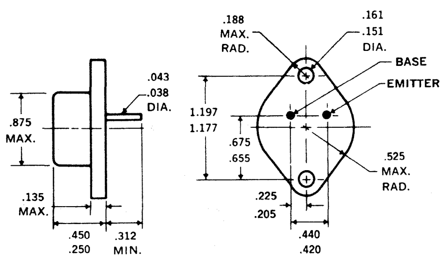
Unitrode power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for power supply pulse amplifier and similar high efficiency power switching applications.

ABSOLUTE MAXIMUM RATINGS

	UPT1131	UPT1132	UPT1133	UPT1134	UPT1135
Collector-Base Voltage, V_{CBO}	60V	80V	100V	120V	150V
Collector-Emitter Voltage, V_{CEO}	40V	60V	80V	100V	100V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V	5V
D.C. Collector Current, I_C	20A	20A	20A	20A	20A
Peak Collector Current, I_C	30A	30A	30A	30A	30A
Base Current, I_B	7A	7A	7A	7A	7A
Power Dissipation					
25°C Ambient					3.5W
100°C Case					70W
Thermal Resistance, θ_{J-C}					1.43°C/W
Operating and Storage Temperature Range					—65°C to 200°C

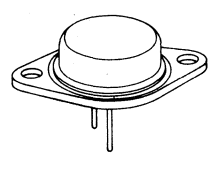
MECHANICAL SPECIFICATIONS

UPT1131 UPT1132 UPT1133 UPT1134 UPT1135



Dimensions in inches.

TO-3



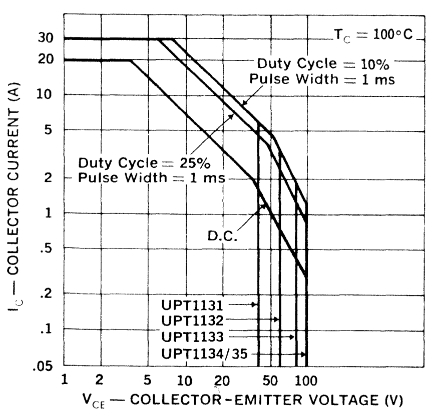
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

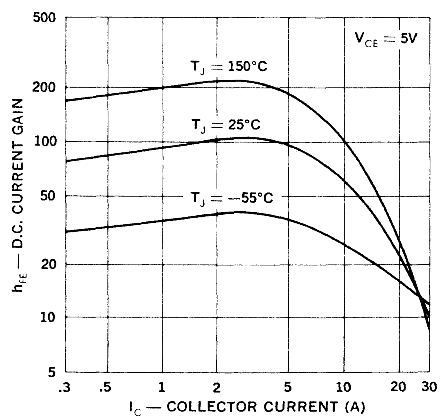
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	30	—	—	$I_C = 10A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	15	—	—	$I_C = 20A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	10 Typ.		—	$I_C = 30A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.5	Vdc	$I_C = 20A$, $I_B = 2A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	2.2	Vdc	$I_C = 20A$, $I_B = 2A$
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CER}			Vdc	$I_C = 10mAdc$; $R_{BE} = 100\Omega$
UPT1131		60	—		
UPT1132		80	—		
UPT1133		100	—		
UPT1134		120	—		
UPT1135		150	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPT1131		40	—		
UPT1132		60	—		
UPT1133		80	—		
UPT1134-35		100	—		
Collector-Emitter Cutoff Current	I_{CER}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$
Collector-Emitter Cutoff Current, 150°C	I_{CER}	—	1.0	mAdc	V_{CE} = rated BV_{CEO}, $R_{BE} = 100\Omega$, $T = 150°C$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	60 Typ.		MHz	$I_C = 2Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Switching Speeds — Turn-on Time	t_{on}	300 Typ.		ns	$I_C = 20A$
Switching Speeds — Turn-off Time	t_{off}	600 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ≤2%.

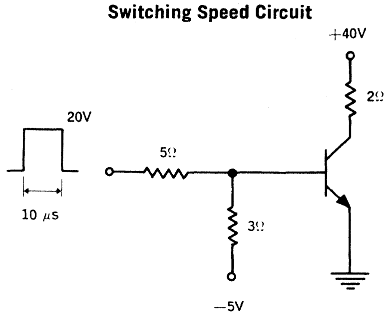
Maximum Safe Operating Area UPT1131-1135



D.C. Current Gain vs. Collector Current



Switching Speed Circuit



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POWER TRANSISTORS
0.5 Amp, 300V, Planar NPN, Plastic

UPTA510
UPTA520
UPTA530

FEATURES
- Designed for High Speed Switching Applications
- Collector-Emitter Voltage: up to 300V
- Peak Collector Current: 1A
- Economical Plastic Molded Construction

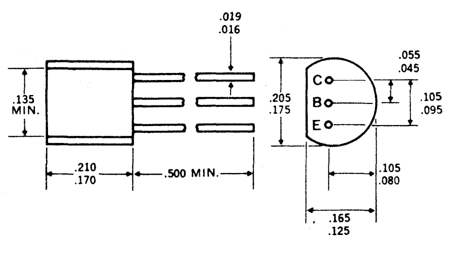
DESCRIPTION
Unitrode high voltage transistors provide a unique combination of low saturation voltage, fast switching, and excellent gain. They are ideally suited for off-line power supply designs and other applications where the increased voltage rating adds to system reliability.

ABSOLUTE MAXIMUM RATINGS

	UPTA510	UPTA520	UPTA530
Collector-Base Voltage, V_{CBO}	150V	250V	350V
Collector-Emitter Voltage, V_{CEO}	100V	200V	300V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V
D.C. Collector Current, I_C	.5A	.5A	.5A
Peak Collector Current, I_C	1A	1A	1A
Base Current, I_B	.5A	.5A	.5A
Power Dissipation			
25°C Case	2.4W		
25°C Ambient	750mW		
Thermal Resistance, θ_{J-C}	62.5°C/W		
Thermal Resistance, θ_{J-A}	200°C/W		
Storage Temperature Range	−55°C to +150°C		
Maximum Junction Temperature	+175°C		

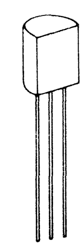
MECHANICAL SPECIFICATIONS

UPTA510 UPTA520 UPTA530



Dimensions in inches.

TO-92



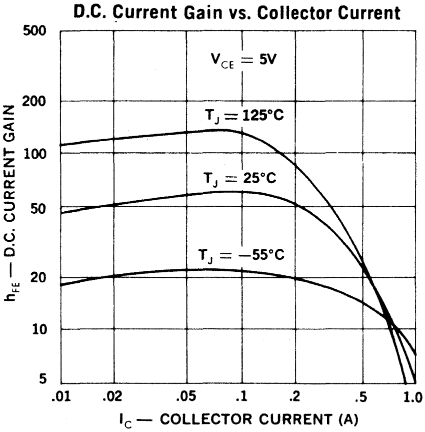
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

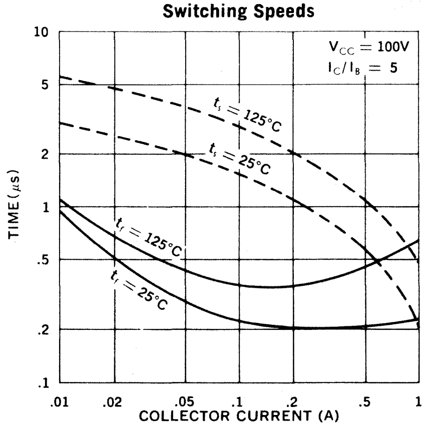
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = .1A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	8	—	—	$I_C = .5A$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5 Typ.		—	$I_C = 1A$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.0	Vdc	$I_C = .5A$, $I_B = .1A$
	V_{CE} (sat)		.5	Vdc	$I_C = .2A$, $I_B = .02A$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = .5A$, $I_B = .1A$
Collector-Base Breakdown Voltage (Note 1)	BV_{CBO}			Vdc	$I_C = 10\mu Adc$
UPTA510		150	—		
UPTA520		250	—		
UPTA530		350	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 10mAdc$
UPTA510		100	—		
UPTA520		200	—		
UPTA530		300	—		
Collector-Emitter Cutoff Current	I_{CES}	—	10	µAdc	V_{CE} = rated BV_{CEO}, $V_{BE} = 0$
Collector-Emitter Cutoff Current	I_{CES}	—	1	mAdc	V_{CE} = rated BV_{CEO}, $T = 125°C$, $V_{BE} = 0$
Emitter-Base Cutoff Current	I_{EBO}	—	50	µAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, $f = 1MHz$
Gain-Bandwidth Product	f_T	15	—	MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, $f = 10MHz$
Rise Time	t_r	100 Typ.		ns	$I_C = .5A$
Delay Time	t_d	50 Typ.		ns	
Storage Time	t_s	500 Typ.		ns	
Fall Time	t_f	200 Typ.		ns	

Note: 1. Pulse width = 300 µs; duty cycle ⩽ 2%.

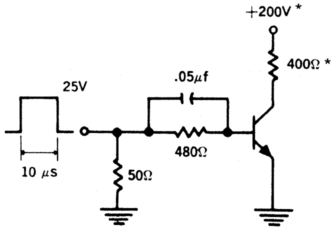
D.C. Current Gain vs. Collector Current



Switching Speeds



Switching Speed Circuit



*Note: For UPTA 410/510, V_{CC} = 100V, R_L = 200Ω

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POWER TRANSISTORS

0.1 Amp, 500V, Planar NPN, Plastic

UPTB520
UPTB530
UPTB540
UPTB550

FEATURES

- Designed for High Speed Switching Applications
- Collector-Emitter Voltage: up to 500V
- Peak Collector Current: to .2A
- Economical Plastic Molded Construction

DESCRIPTION

Unitrode high voltage power transistors provide a unique combination of low saturation voltage, high gain and fast switching. They are ideally suited for pulse power applications in power supplies, thermal printers, solid state relays and pulse amplifiers.

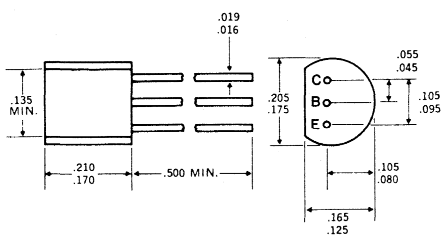
ABSOLUTE MAXIMUM RATINGS

	UPTB520	UPTB530	UPTB540	UPTB550
Collector-Base Voltage, V_{CBO}	250V	350V	450V	550V
Collector-Emitter Voltage, V_{CEO}	200V	300V	400V	500V
Emitter-Base Voltage, V_{EBO}	5V	5V	5V	5V
D.C. Collector Current, I_C	.1A	.1A	.1A	.1A
Peak Collector Current, I_C	.2A	.2A	.2A	.2A
Base Current, I_B	.1A	.1A	.1A	.1A

	All types
Power Dissipation	
25°C Case	2.4W
25°C Ambient	750mW
Thermal Resistance, Θ_{J-C}	62.5°C/W
Thermal Resistance, Θ_{J-A}	200°C/W
Storage Temperature Range	−55°C to +150°C
Maximum Junction Temperature	+175°C

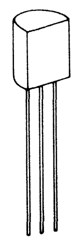
MECHANICAL SPECIFICATIONS

UPTB520 UPTB530 UPTB540 UPTB550



Dimensions in inches.

TO-92



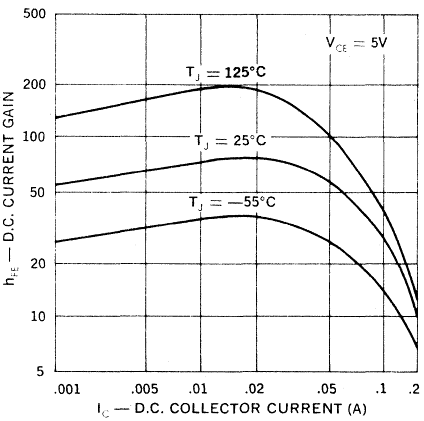
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

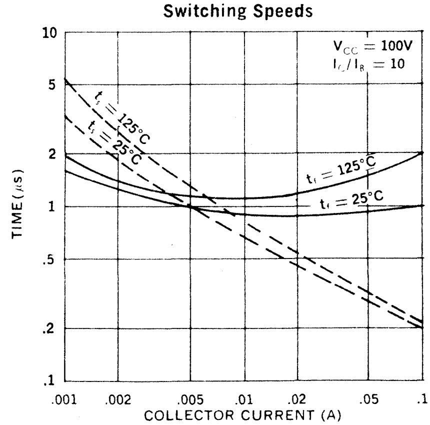
Test	Symbol	Min.	Max.	Units	Test Conditions
D.C. Current Gain (Note 1)	h_{FE}	20	—	—	$I_C = 25mA$, $V_{CE} = 5Vdc$
D.C. Current Gain (Note 1)	h_{FE}	5	—	—	$I_C = 100mA$, $V_{CE} = 5Vdc$
Collector Saturation Voltage (Note 1)	V_{CE} (sat)	—	1.2	Vdc	$I_C = 50mA$, $I_B = 10mA$
	V_{CE} (sat)		.5	Vdc	$I_C = 20mA$, $I_B = 2mA$
Base Saturation Voltage (Note 1)	V_{BE} (sat)	—	1.5	Vdc	$I_C = 50mA$, $I_B = 10mA$
Collector-Base Breakdown Voltage (Note 1)	BV_{CBO}			Vdc	$I_C = 10\mu Adc$
UPTB520		250	—		
UPTB530		350	—		
UPTB540		450	—		
UPTB550		550	—		
Collector-Emitter Breakdown Voltage (Note 1)	BV_{CEO}			Vdc	$I_C = 1mAdc$
UPTB520		200	—		
UPTB530		300	—		
UPTB540		400	—		
UPTB550		500	—		
Collector-Emitter Cutoff Current	I_{CES}	—	10	μAdc	V_{CE} = rated BV_{CEO}, $V_{BE} = 0$
Collector-Emitter Cutoff Current	I_{CES}	—	1	mAdc	V_{CE} = rated BV_{CEO}, T = 125°C, $V_{BE} = 0$
Emitter-Base Cutoff Current	I_{EBO}	—	50	μAdc	$V_{EB} = 5Vdc$
Output Capacitance	C_{ob}	—	50	pf	$V_{CB} = 10Vdc$, $I_E = 0$, f = 1MHz
Gain-Bandwidth Product	f_T	15	—	MHz	$I_C = 1Adc$, $V_{CE} = 5Vdc$, f = 10MHz
Rise Time	t_r	100 Typ.		ns	$I_C = 100mA$
Delay Time	t_d	50 Typ.		ns	
Storage Time	t_s	200 Typ.		ns	
Fall Time	t_f	1000 Typ.		ns	

Note: 1. Pulse width = 300 μs; duty cycle ⩽ 2%.

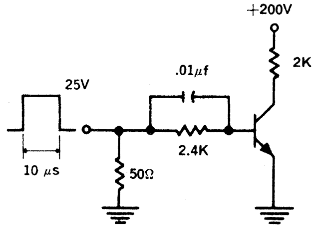
D.C. Current Gain vs. Collector Current



Switching Speeds



Switching Speed Circuit



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RECTIFIERS

Radiation Tolerant, 1 Amp-2 Amp

UR105-UR125
UR205-UR225

FEATURES

- Radiation Tolerant: to 10^{16} NVT
- Continuous Rating: to 2A
- Controlled Avalanche
- Surge Rating: to 25A
- Miniature Package

DESCRIPTION

These devices are particularly suited to applications where radiation is present. These units have unique ability to withstand high levels of neutron, gamma and electron radiation.

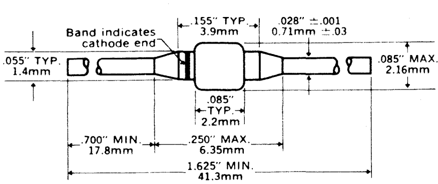
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	2 Amp Series
50V	UR105	UR205
100V	UR110	UR210
150V	UR115	UR215
200V	UR120	UR220
250V	UR125	UR225

	1 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current		
@ $T_A = 25°C$	1A	2A
@ $T_A = 100°C$	0.5A	1A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	20A	25A
Operating Temperature Range	−195°C to +175°C	
Storage Temperature Range	−195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UR105-UR125 UR205-UR225



Part Identification: White band indicates "UR." Part number printed on body.

Polarity: Denoted by white band.

Weight: 0.26 grams, typical.

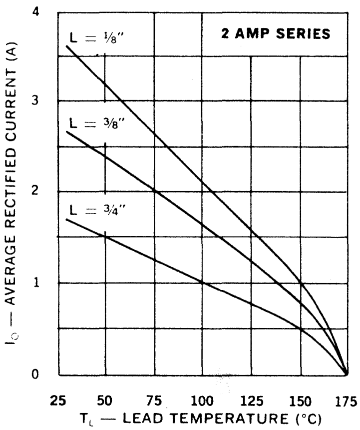
BODY A

UNITRODE

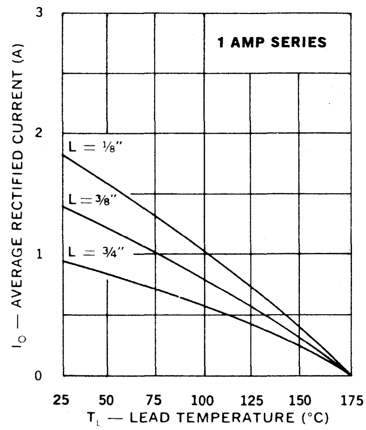
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV 25°C	Maximum Leakage Current @ PIV 100°C	Maximum Radiation Tolerance
UR205	50V				10^{16} NVT
UR210	100V				10^{16}
UR215	150V	1.0V @ 1A	3μA	50μA	10^{15}
UR220	200V				10^{14}
UR225	250V				10^{14}
UR105	50V				10^{16}
UR110	100V				10^{16}
UR115	150V	1.0V @ 0.5A	3μA	50μA	10^{15}
UR120	200V				10^{14}
UR125	250V				10^{14}

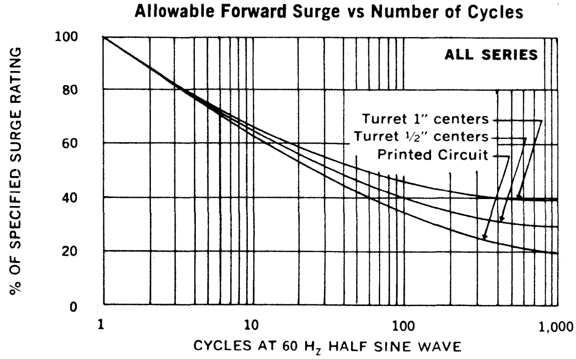
Maximum Current vs Lead Temperature



Maximum Current vs Lead Temperature



Allowable Forward Surge vs Number of Cycles



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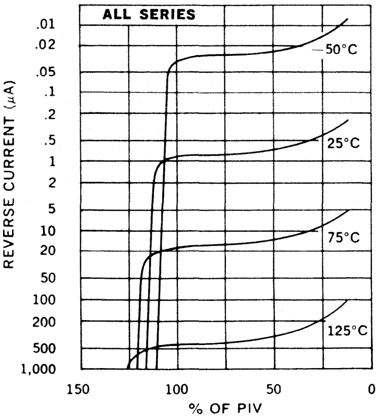
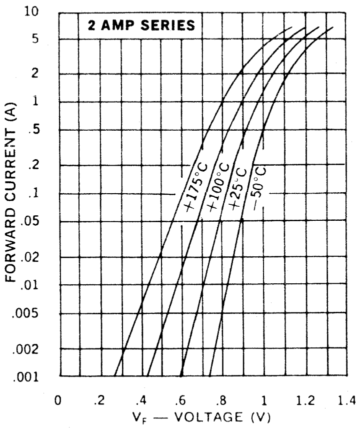
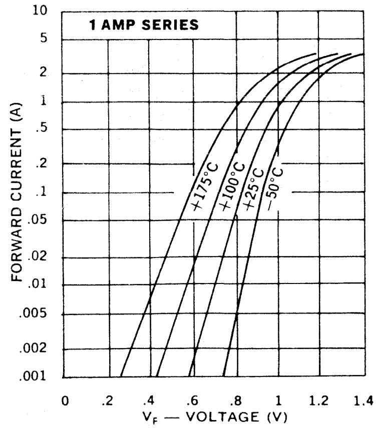
Typical Reverse Current vs PIV



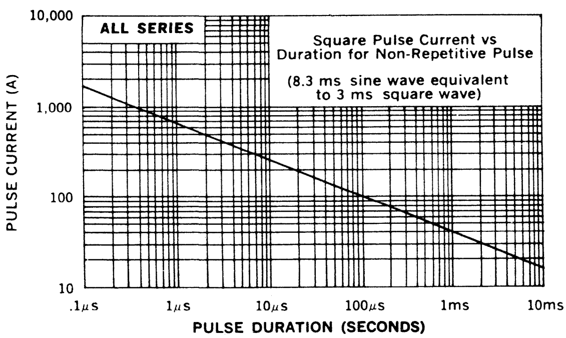
Typical Forward Current vs Forward Voltage



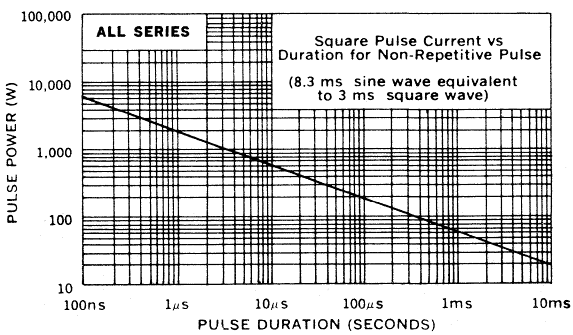
Typical Forward Current vs Forward Voltage



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIER ASSEMBLIES

US12–US200A
USR12–USR180A

High Voltage Stacks, .125 Amp to 1 Amp, Standard and Fast Recovery

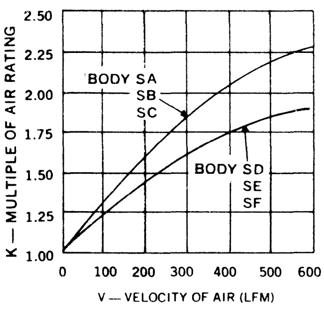
FEATURES
- Controlled Avalanche Characteristics
- Recovery Times: to 500ns
- Transfer Molded for Voidless Encapsulation
- High Forward and Reverse Surge Capability
- PIV: from 1200 to 20,000V
- Only Fused-in-Glass Diodes Used

DESCRIPTION
This series of High Voltage, Medium Current Stacks are assembled from hermetically sealed, controlled avalanche individual diodes. Therefore, they offer the ultimate in reliability for such applications as clipper diodes, back swing diodes and hold-off diodes in pulse modulators.

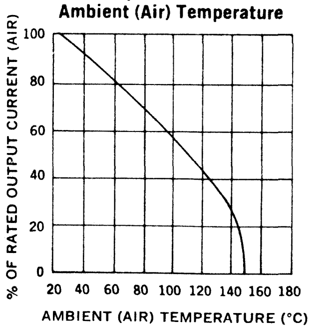
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1200 to 20,000V
Maximum Average D.C. Output Current	See Electrical Specifications
Non-Repetitive Sinusoidal Surge (8.3ms)	20A
Operating and Storage Temperature Range	−65°C to +150°C

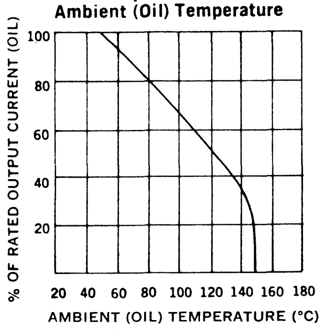
Output Current Ratio vs Velocity of Air Flow



Output Current vs Ambient (Air) Temperature



Output Current vs Ambient (Oil) Temperature

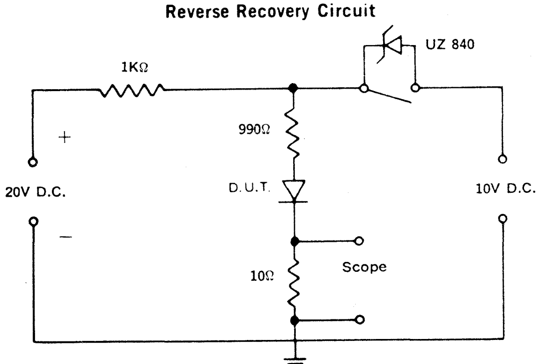


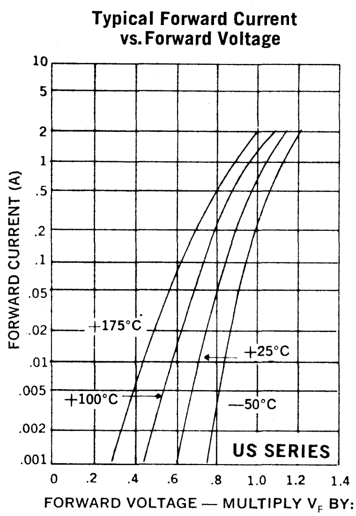
UNITRODE

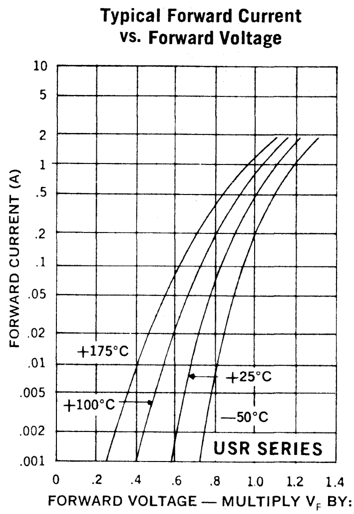
Type	PIV	Maximum Leakage Current at PIV		Maximum Forward Voltage Drop	Maximum Reverse Recovery Time†	Body Size	Maximum Ratings: Max. Avg. D.C. Output Current	
		$T_A = 25°C$	$T_A = 100°C$				$T_A = 25°C$ (Air)	$T_A = 50°C$ (Oil)
	V	μA	μA		ns		mA	mA
Standard Recovery								
US 12	1200	2	100	2.0V @ 400mA		SA	1000	2500
US 15	1500	2	100	3.0V @ 400mA	—	SA	800	2000
US 18	1800	2	100	3.0V @ 400mA		SA	700	1750
US 20	2000	2	100	4.0V @ 400mA		SA	600	1500
US 25	2500	2	100	5.0V @ 400mA	—	SB	600	1500
US 30	3000	2	100	6.0V @ 400mA		SB	500	1250
US 35	3500	2	100	7.0V @ 200mA	—	SC	400	1000
US 40	4000	2	100	7.0V @ 200mA		SC	350	850
US 45A	4500	2	100	8.0V @ 200mA		SD	330	750
US 50A	5000	2	100	9.0V @ 200mA	—	SD	330	750
US 60A	6000	2	100	10.0V @ 200mA		SD	300	620
US 70A	7000	2	100	12.0V @ 200mA		SD	300	620
US 80A	8000	2	100	14.0V @ 100mA		SE	250	500
US 100A	10000	2	100	17.0V @ 100mA	—	SE	250	500
US 120A	12000	2	100	21.0V @ 100mA		SE	200	400
US 150A	15000	2	100	26.0V @ 100mA		SF	200	400
US 180A	18000	2	100	31.0V @ 100mA	—	SF	180	360
US 200A	20000	2	100	34.0V @ 100mA		SF	180	360
Fast Recovery								
USR 12	1200	5	150	3.3V @ 400mA	500	SA	750	1850
USR 15	1500	5	150	4.0V @ 400mA	500	SA	600	1500
USR 20	2000	5	150	5.5V @ 400mA	500	SB	500	1250
USR 25	2500	5	150	6.6V @ 400mA	500	SB	400	1000
USR 30	3000	5	150	7.7V @ 400mA	500	SC	400	1000
USR 35	3500	5	150	8.8V @ 200mA	500	SC	350	850
USR 40A	4000	5	150	9.9V @ 200mA	500	SD	300	750
USR 45A	4500	5	150	11.0V @ 100mA	500	SD	250	625
USR 50A	5000	5	150	13.0V @ 100mA	500	SD	250	625
USR 60A	6000	5	150	15.4V @ 100mA	500	SD	220	500
USR 70A	7000	5	150	17.6V @ 100mA	500	SE	220	500
USR 80A	8000	5	150	20.0V @ 100mA	500	SE	200	400
USR 100A	10000	5	150	24.0V @ 100mA	500	SE	200	400
USR 120A	12000	5	150	31.0V @ 100mA	500	SF	150	300
USR 150A	15000	5	150	33.0V @ 100mA	500	SF	150	300
USR 180A	18000	5	150	35.0V @ 100mA	500	SF	125	250

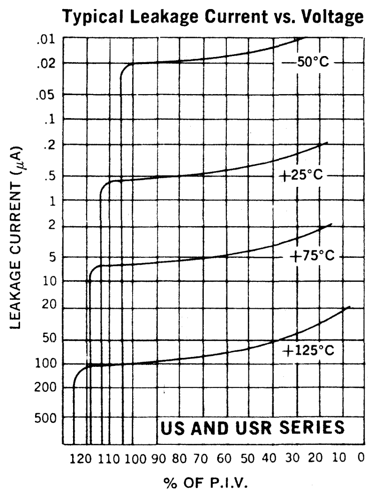
†Measured in a reverse recovery circuit switching from 10mA forward to 10mA reverse current recovering to 5mA.

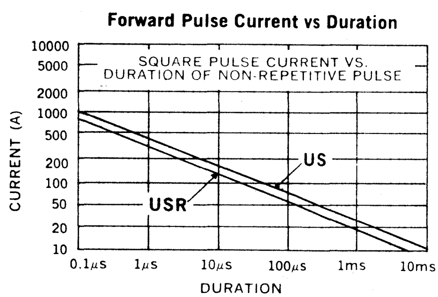
Reverse Recovery Circuit

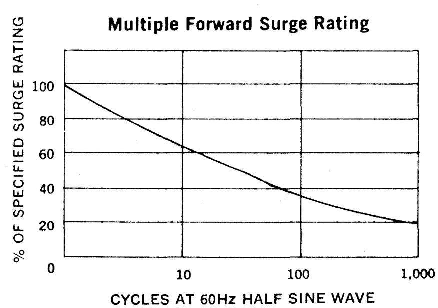



Typical Forward Current vs. Forward Voltage
FORWARD CURRENT (A)
+175°C
+25°C
+100°C
—50°C
US SERIES
FORWARD VOLTAGE — MULTIPLY V_F BY:

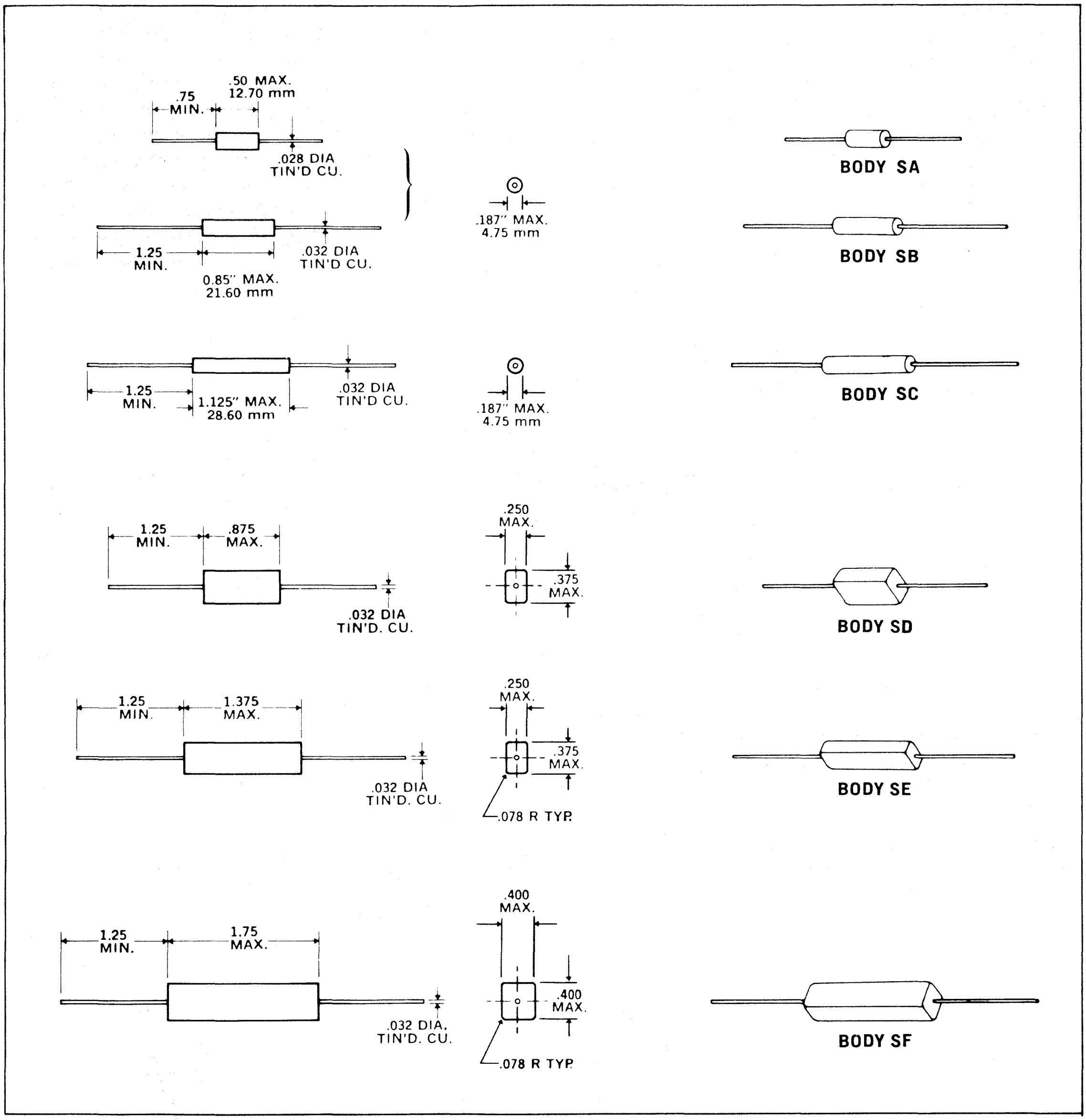

Typical Forward Current vs. Forward Voltage
FORWARD CURRENT (A)
+175°C
+25°C
+100°C
—50°C
USR SERIES
FORWARD VOLTAGE — MULTIPLY V_F BY:


Typical Leakage Current vs. Voltage
LEAKAGE CURRENT (μA)
—50°C
+25°C
+75°C
+125°C
US AND USR SERIES
% OF P.I.V.


Forward Pulse Current vs Duration
SQUARE PULSE CURRENT VS.
DURATION OF NON-REPETITIVE PULSE
CURRENT (A)
US
USR
DURATION


Multiple Forward Surge Rating
% OF SPECIFIED SURGE RATING
CYCLES AT 60Hz HALF SINE WAVE

MECHANICAL SPECIFICATIONS



POWER SCHOTTKY RECTIFIERS

150A Pk, Up to 45V

USD520
USD535
USD545

FEATURES

- Very Low Forward Drop (0.6V at 60A, 125°C)
- Low Recovered Charge
- Rugged Package Design (DO-5)
- High Efficiency for Low Voltage Supplies
- Low Thermal Resistance (0.8°C/W)
- High Surge Current (1000A)
- Low Reverse Current (<50 mA at rated V_R at 125°C)

DESCRIPTION

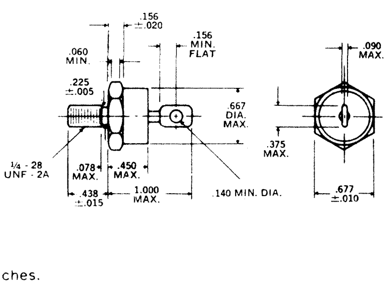
The USD545 series of Schottky barrier power rectifiers is ideally suited for output rectifiers and catch diodes in low voltage power supplies. The Unitrode high conductivity design, using a heavy copper top post and 4 point crimp, ensures cool thermal operation and low dynamic impedance. Rugged design absorbs stress that can damage glass-to-metal seal during installation and use.

ABSOLUTE MAXIMUM RATINGS

Rating	Symbol	USD 520	USD 535	USD 545	Units
Working Peak Reverse Voltage	V_{RWM}	20	35	45	Volts
DC Blocking Voltage	V_R	20	35	45	Volts
Peak Repetitive Forward Current (Rated V_R, Square Wave, 20 KHz, 50 percent Duty Cycle)	I_{FRM}	150 (at T_C = 115°C)			Amp
Average Rectified Forward Current	$I_{F(AV)}$	75 (at T_C = 115°C)			Amp
Non-repetitive Peak Surge Current (8.3 mS)	I_{FSM}	1000			Amp
Operating and Storage Temperature Range	T_j, T_{stg}	−55 to +165			°C
Peak Operating Junction Temperature	$T_{j(pk)}$	+175			°C
Thermal Resistance Junction to Case	$R_{\Theta JC}$	0.8			°C/W

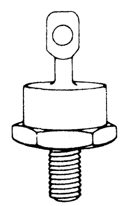
MECHANICAL SPECIFICATIONS

USD520
USD535
USD545



Dimensions in inches.

DO-5



Notes:
1. Cathode is stud.
2. All metal surfaces tin plated.
3. Maximum unlubricated stud torque: 30 inch pounds.
4. Angular orientation of terminal is undefined.

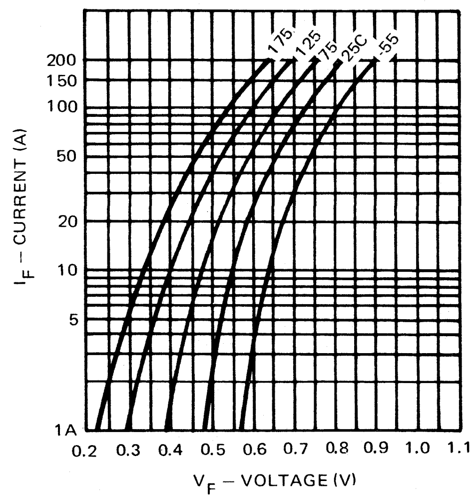
5-77

UNITRODE

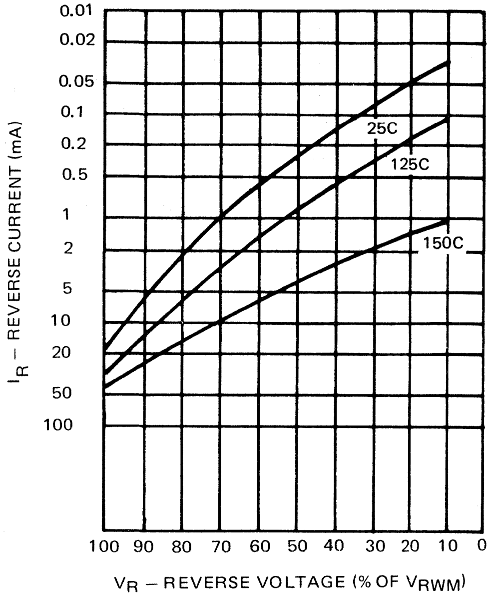
ELECTRICAL CHARACTERISTICS (T_{CASE} = 25°C)

Characteristic	Symbol	All	Units	Conditions
Maximum Instantaneous Reverse Current	i_R	50	mA	v_R = rated, T_C = 125°C Pulse Width = 300μs, Duty Cycle = 1 percent
Maximum Instantaneous Forward Voltage	v_F	0.60	Volts	i_F = 60A T_C = 125°C,
Maximum Capacitance	C_t	4000	pF	V_R = 5.0V
Minimum Rate of Change of Voltage	dv/dt	700	v/μs	v_R = rated

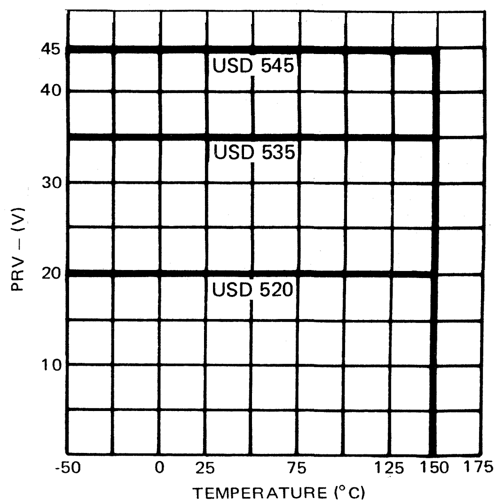
Typical Forward Current vs Forward Voltage



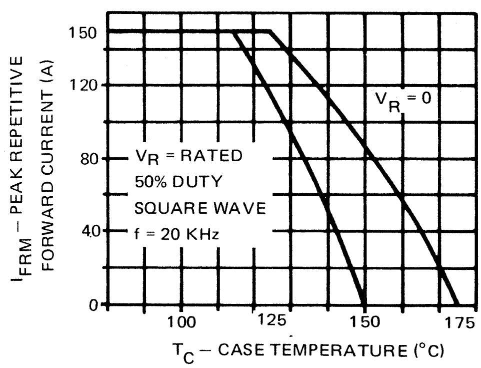
Typical Reverse Current vs Reverse Voltage



$V_{R(MAX)}$ Rating vs Case Temperature



Maximum Current vs Case Temperature



RECTIFIERS

Standard Recovery, 1 Amp to 2 Amp

UT236-UT347
UT249-UT363
UT251-UT364
UT261-UT268

FEATURES

- Continuous Rating: to 2A
- Controlled Avalanche
- Surge Rating: to 30A
- PIV: to 1000V
- Miniature Package

DESCRIPTION

These miniature power rectifiers offer the user extreme reliability for high-rel military supplies.

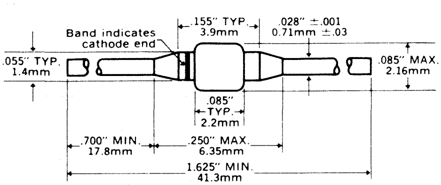
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	1.25 Amp Series	1.5 Amp Series	2 Amp Series
100V	UT236	UT249	UT251	UT261
200V	UT234	UT242	UT252	UT262
400V	UT235	UT244	UT254	UT264
500V	UT237	UT245	UT255	UT265
600V	UT238	UT247	UT257	UT267
800V	UT361	UT362	UT258	UT268
1000V	UT347	UT363	UT364	

	1 AMP SERIES	1.25 AMP SERIES	1.5 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current				
@ $T_A = 25°C$	1.0A	1.25A	1.5A	2.0A
@ $T_A = 100°C$	0.5A	0.65A	0.75A	1.0A
Non-Repetitive Sinuosoidal Surge (8.3ms)	20A	20A	25A	30A
Operating Temperature Range	—195°C to +175°C			
Storage Temperature Range	—195°C to +175°C			
Thermal Resistance	See lead temperature derating curve			

MECHANICAL SPECIFICATIONS

UT236-UT347 UT249-UT363 UT251-UT364 UT261-UT268



Part Identification: Orange band indicates "UT." Part number printed on body.

Polarity: Denoted by orange band.

Weight: 0.26 grams, typical.

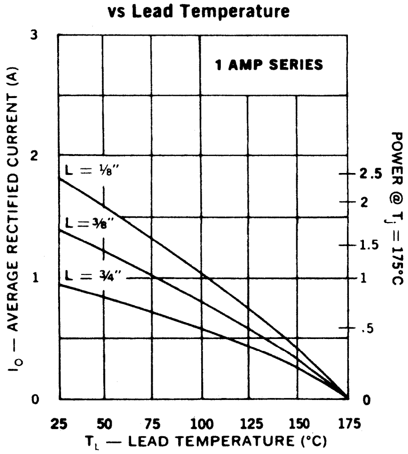
BODY A

UNITRODE

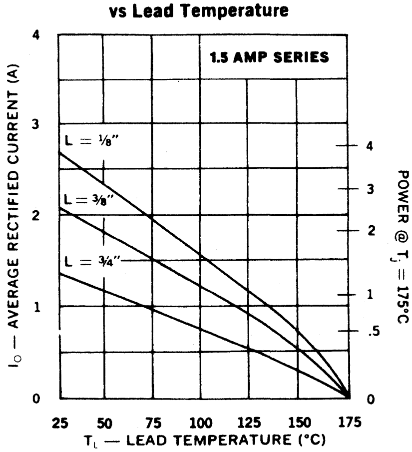
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV 25°C	Maximum Leakage Current @ PIV 100°C
UT261 UT262 UT264 UT265 UT267 UT268	100V 200V 400V 500V 600V 800V	1V @ 900mA	2μA	75μA
UT251 UT252 UT254 UT255 UT257 UT258 UT364	100V 200V 400V 500V 600V 800V 1000V	1V @ 750mA	2μA	75μA
UT249 UT242 UT244 UT245 UT247 UT362 UT363	100V 200V 400V 500V 600V 800V 1000V	1V @ 500mA	2μA	75μA
UT236 UT234 UT235 UT237 UT238 UT361 UT347	100V 200V 400V 500V 600V 800V 1000V	1V @ 400mA	2μA	75μA

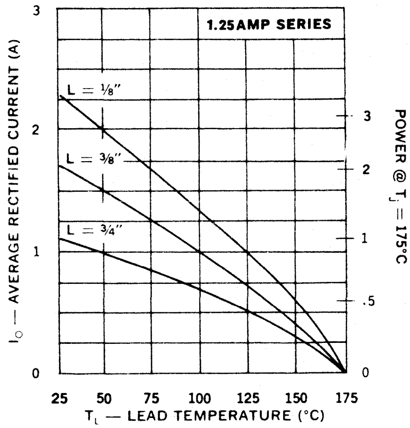
Maximum Current vs Lead Temperature



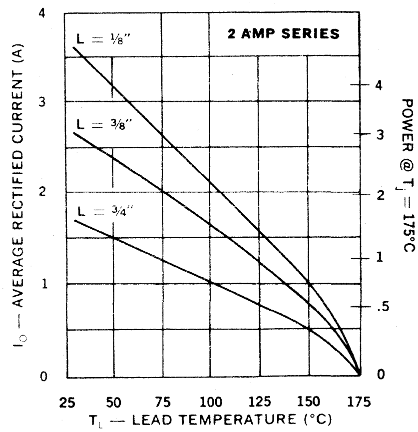
Maximum Current vs Lead Temperature



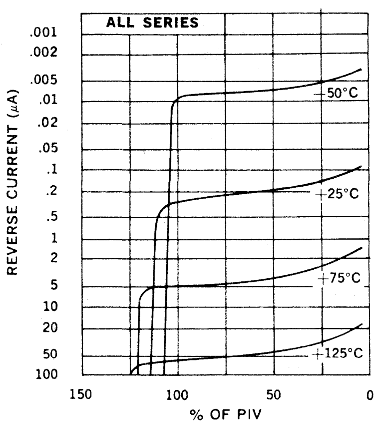
Maximum Current vs Lead Temperature



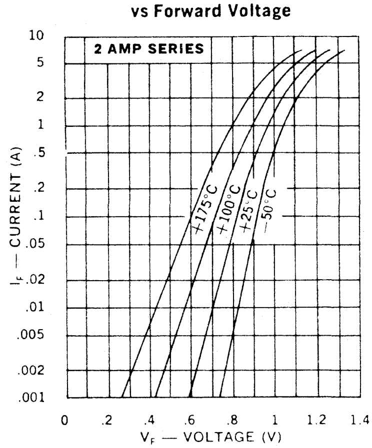
Maximum Current vs Lead Temperature



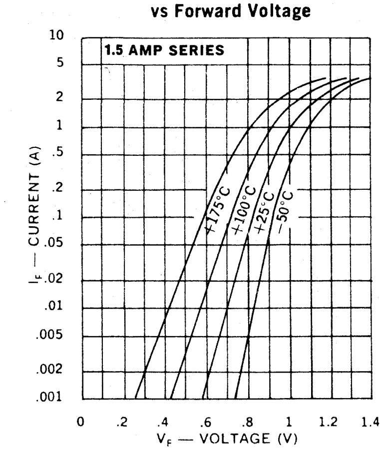
Typical Leakage Current vs. PIV



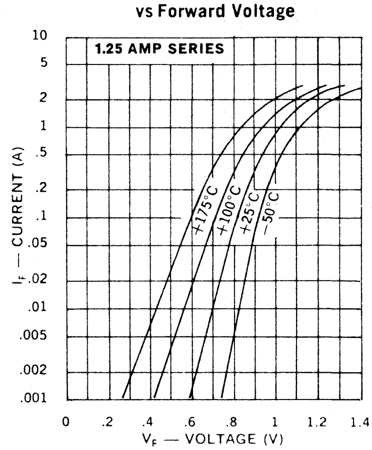
Typical Forward Current vs Forward Voltage



Typical Forward Current vs Forward Voltage



Typical Forward Current vs Forward Voltage



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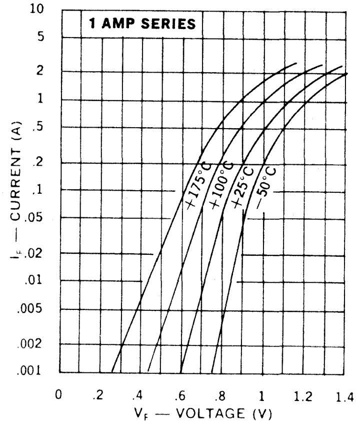
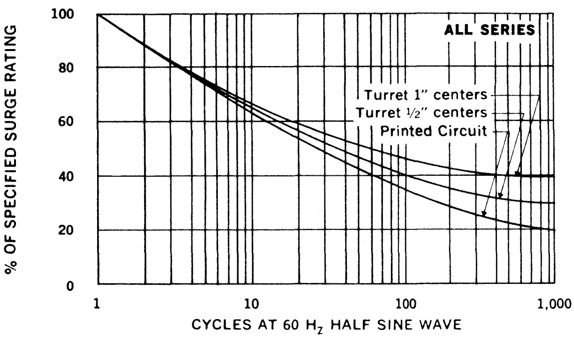
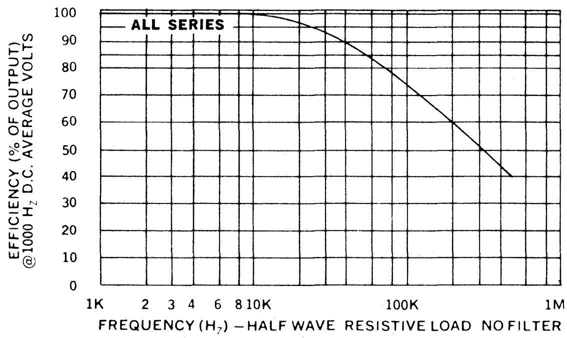
Typical Forward Current vs Forward Voltage



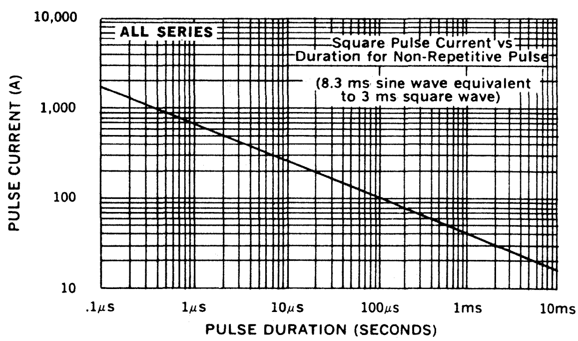
Allowable Forward Surge vs Number of Cycles



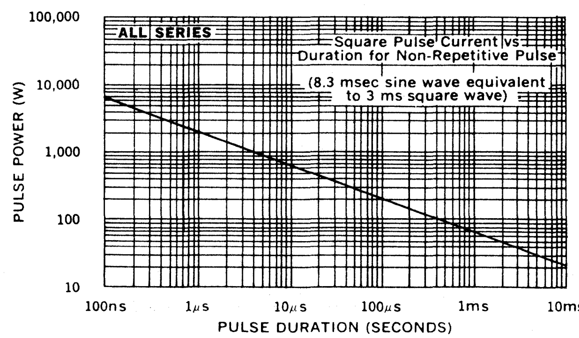
Efficiency vs Frequency at Rated Current (Sine Wave)



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS
Standard Recovery, 2 Amp to 4 Amp

UT2005-UT2060
UT3005-UT3060
UT4005-UT4060

FEATURES
- Continuous Rating: to 4A
- Controlled Avalanche
- Surge Rating: to 100A
- PIV: to 600 V
- Miniature Package

DESCRIPTION
High average power and surge capability make these series of devices attractive in many high-rel applications.

All Unitrode rectifiers have a sleeve of pure hard glass fused to the silicon junction. Since the silicon sees only this glass, electrical characteristics are permanently stable. This voidless, monolithic package is totally unaffected by the most severe moisture or temperature testing.

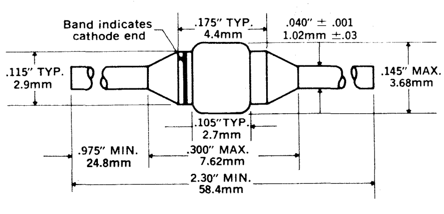
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2 Amp Series	3 Amp Series	4 Amp Series
50V	UT2005	UT3005	UT4005
100V	UT2010	UT3010	UT4010
200V	UT2020	UT3020	UT4020
400V	UT2040	UT3040	UT4040
600V	UT2060	UT3060	UT4060

	2 AMP SERIES	3 AMP SERIES	4 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_A = 25°C$	2.0A	3.0A	4.0A
@ $T_A = 100°C$	1.0A	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A	100A
Operating Temperature Range		−195°C to +175°C	
Storage Temperature Range		−195°C to +200°C	
Thermal Resistance		See lead temperature derating curve	

MECHANICAL SPECIFICATIONS

UT2005-UT2060 UT3005-UT3060 UT4005-UT4060



Part Identification: Orange band indicates "UT." Part number printed on body.

Polarity: Denoted by orange band.

Weight: 0.75 grams, typical.

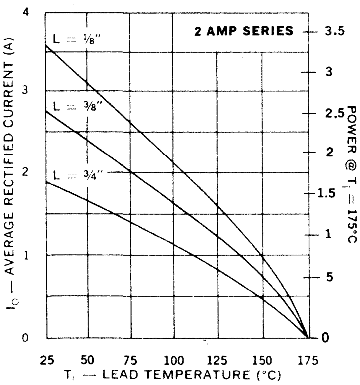
BODY B

UNITRODE

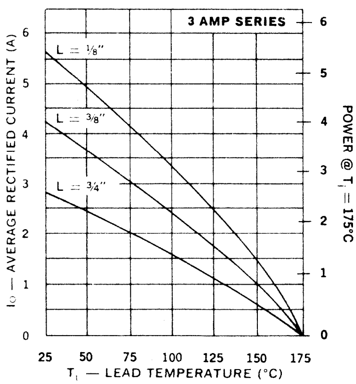
ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV 25°C	Maximum Leakage Current @ PIV 100°C
UT4005 UT4010 UT4020 UT4040 UT4060	50V 100V 200V 400V 600V	1V @ 3A	5μA	100μA
UT3005 UT3010 UT3020 UT3040 UT3060	50V 100V 200V 400V 600V	1V @ 2A	5μA	100μA
UT2005 UT2010 UT2020 UT2040 UT2060	50V 100V 200V 400V 600V	1V @ 1A	5μA	100μA

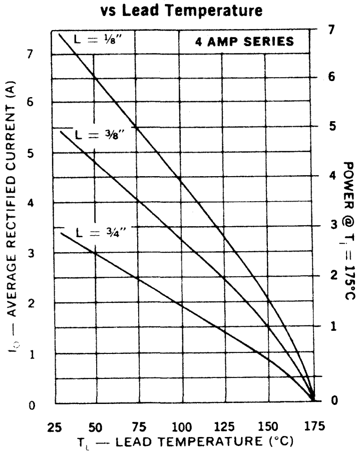
Maximum Current vs Lead Temperature



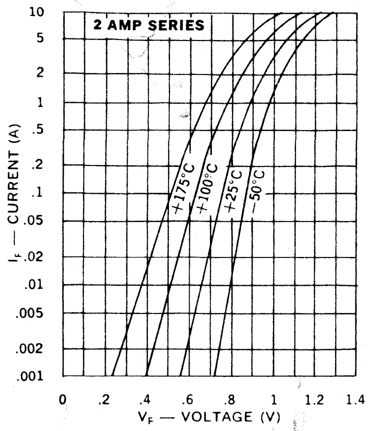
Maximum Current vs Lead Temperature



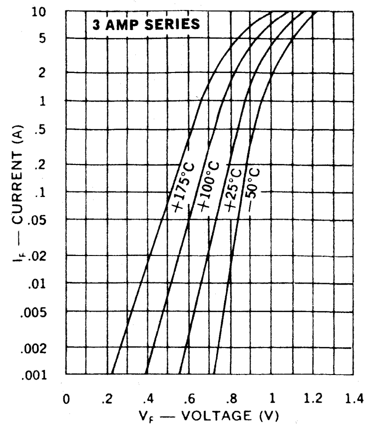
Maximum Current vs Lead Temperature



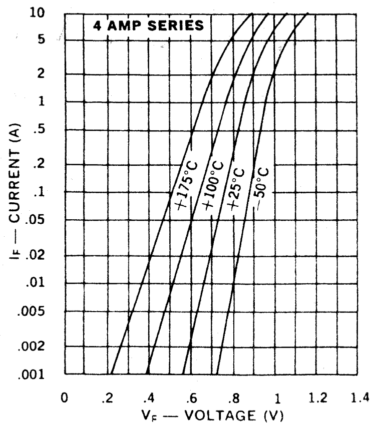
Typical Forward Current vs Forward Voltage



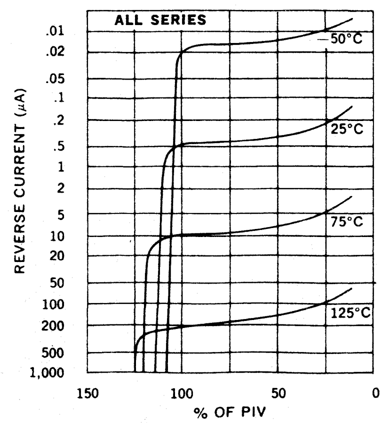
Typical Forward Current vs Forward Voltage



Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



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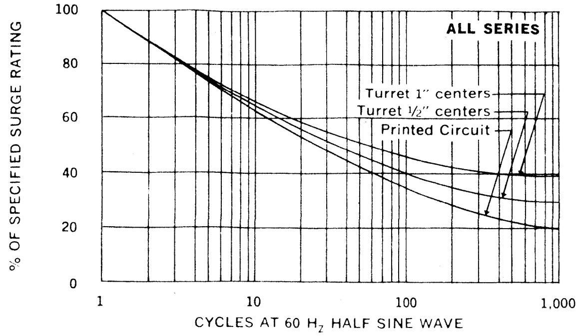
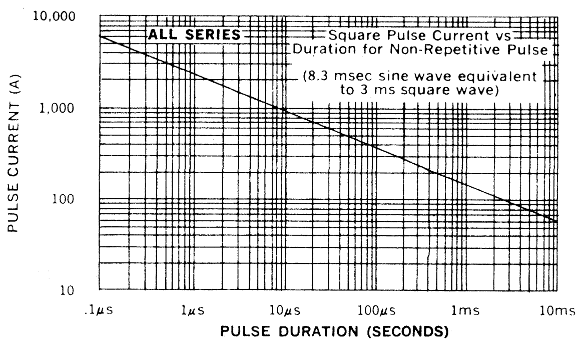
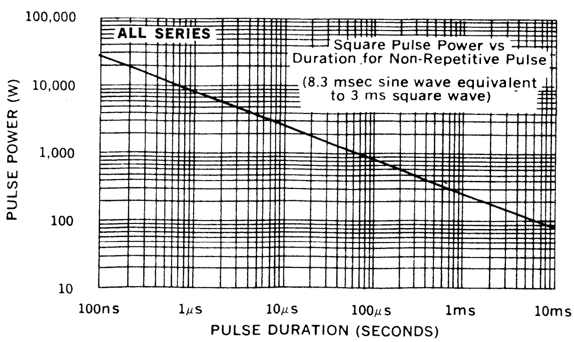
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS

Standard Recovery, 7.5 Amp to 12 Amp

UT5105-UT5160
UT6105-UT6160
UT8105-UT8160

FEATURES
- Rating: 12A
- Controlled Avalanche
- Miniature Package
- Surge Rating: 200A

DESCRIPTION
These series of high current rectifiers offers opportunity for size and weight reduction in high power supplies.

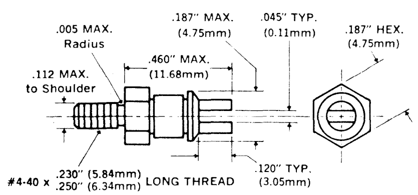
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	12 Amp Series	9 Amp Series	7.5 Amp Series
50V	UT8105	UT6105	UT5105
100V	UT8110	UT6110	UT5110
200V	UT8120	UT6120	UT5120
400V	UT8140	UT6140	UT5140
600V	UT8160	UT6160	UT5160

	12 AMP SERIES	9 AMP SERIES	7.5 AMP SERIES
Maximum Average D.C. Output Current @ $T_C = 100°C$	12.0A	9.0A	7.5A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	200A	175A	150A
Operating and Storage Temperature Range	—65°C to +175°C		
Thermal Resistance, Junction to Case	7.5°C/Watt		
Current Derating	See current vs. case temperature curve		

MECHANICAL SPECIFICATIONS

UT5105-UT5160 UT6105-UT6160 UT8105-UT8160



Part Identification: Numerals and polarity letter indicate "UT" type number; e.g., 8105R.

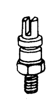
Polarity: Cathode to Stud is standard. Reverse polarity denoted by "R" Suffix.

Finish: Metal parts gold plated per MIL-G-45204, Type II.

Max. Weight: 1.5 grams.

Also available with insulated stud.

BODY C — Stud Mount



Installation
Maximum unlubricated stud torque: 28 inch-ounces.
Insulating hardware supplied.
Do not use a screwdriver in the turret slot for installation purposes, or damage may result.

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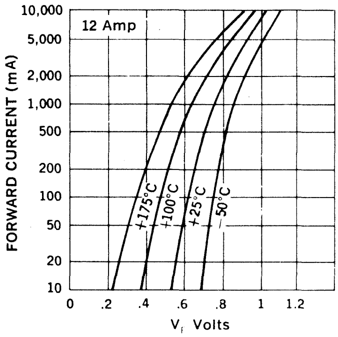
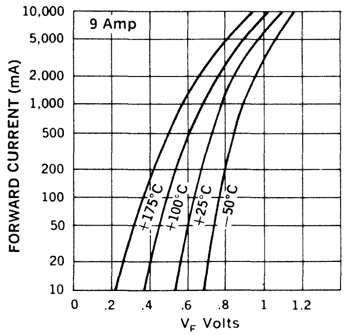
ELECTRICAL SPECIFICATIONS (at 25 C unless noted)

Type	Peak Inverse Voltage	Maximum Forward Voltage	Max. Reverse Current at PIV	
			25°C	100°C
UT8105 UT8110 UT8120 UT8140 UT8160	50V 100V 200V 400V 600V	1V @ 8A	10μA	300μA
UT6105 UT6110 UT6120 UT6140 UT6160	50V 100V 200V 400V 600V	1V @ 6A	10μA	300μA
UT5105 UT5110 UT5120 UT5140 UT5160	50V 100V 200V 400V 600V	1V @ 5A	10μA	300μA

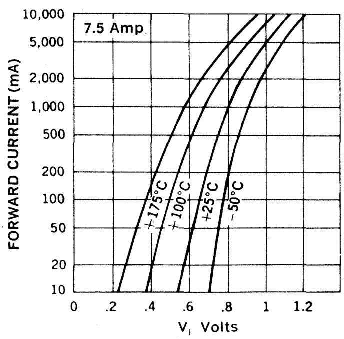
Typical Forward Voltage vs Forward Current



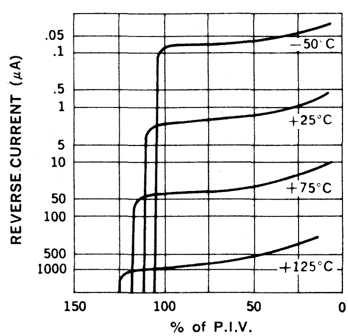
Typical Forward Voltage vs Forward Current



Typical Forward Voltage vs Forward Current



Typical P.I.V. vs Reverse Current



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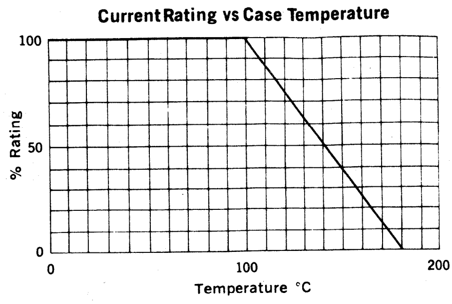

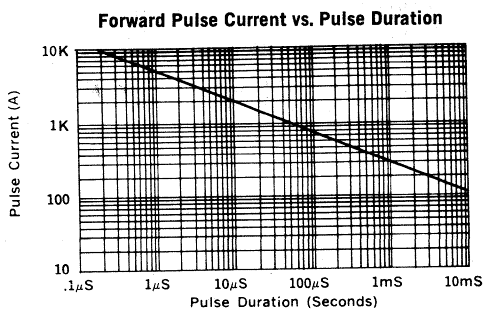

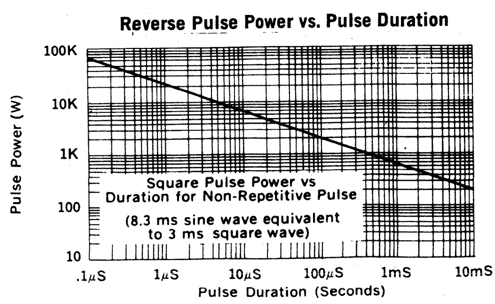

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RECTIFIERS

Fast Recovery, 0.5 Amp to 2 Amp

UTR10-UTR60
UTR01-UTR61
UTR02-UTR62

FEATURES

- Continuous Rating: to 2A
- Controlled Avalanche
- Surge Rating: to 25A
- Fast Recovery 40kHz Operation
- PIV: to 600V
- Miniature Package

DESCRIPTION

These miniature fast recovery rectifiers permit operation at full frequencies as high as 40kHz square wave. They have the unique Unitrode Fused in Glass construction.

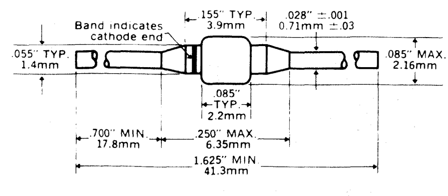
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	½ Amp Series	1 Amp Series	2 Amp Series
50V		UTR01	UTR02
100V	UTR10	UTR11	UTR12
200V	UTR20	UTR21	UTR22
300V	UTR30	UTR31	UTR32
400V	UTR40	UTR41	UTR42
500V	UTR50	UTR51	UTR52
600V	UTR60	UTR61	UTR62

	½ AMP SERIES	1 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_A = 25°C$	0.5A	1.0A	2.0A
@ $T_A = 100°C$	0.25A	0.5A	1.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	15A	20A	25A
Operating Temperature Range	−195°C to +175°C		
Storage Temperature Range	−195°C to +200°C		
Thermal Resistance	See lead temperature derating curves		

MECHANICAL SPECIFICATIONS

UTR10-UTR60 UTR01-UTR61 UTR02-UTR62



Part Identification: Green band indicates "UTR." Part number printed on body.

Polarity: Denoted by Green band.

Weight: 0.26 grams, typical.

BODY A

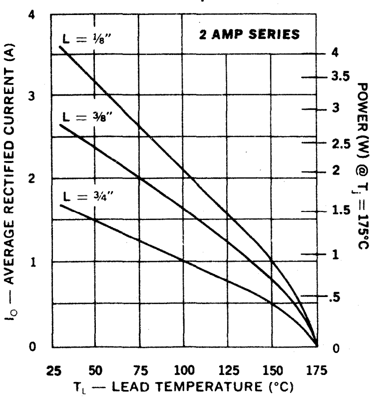
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

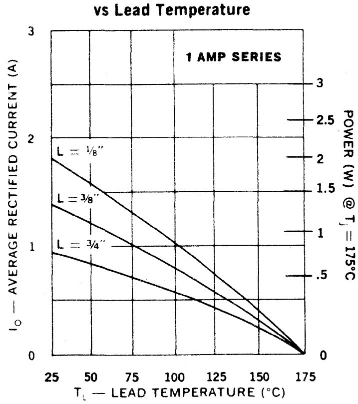
Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time*	Maximum Junction Capacitance @ 25°C	
			25°C	100°C		0V	—10V
UTR02	50V	1.1V @ 1000mA	3μA	100μA	250ns	150pf	60pf
UTR12	100V				250ns	100pf	40pf
UTR22	200V				250ns	80pf	32pf
UTR32	300V				300ns	70pf	28pf
UTR42	400V				350ns	60pf	24pf
UTR52	500V				400ns	50pf	20pf
UTR62	600V				400ns	40pf	16pf
UTR01	50V	1.1V @ 500mA	3μA	100μA	250ns	150pf	60pf
UTR11	100V				250ns	100pf	40pf
UTR21	200V				250ns	80pf	32pf
UTR31	300V				300ns	70pf	28pf
UTR41	400V				350ns	60pf	24pf
UTR51	500V				400ns	50pf	20pf
UTR61	600V				400ns	40pf	16pf
UTR10	100V	1.1V @ 200mA	3μA	100μA	250ns	100pf	40pf
UTR20	200V				250ns	80pf	32pf
UTR30	300V				300ns	70pf	28pf
UTR40	400V				350ns	60pf	24pf
UTR50	500V				400ns	50pf	20pf
UTR60	600V				400ns	40pf	16pf

***Recovery time is measured from 10.0mA to 10.0mA recovery to 5.0mA**

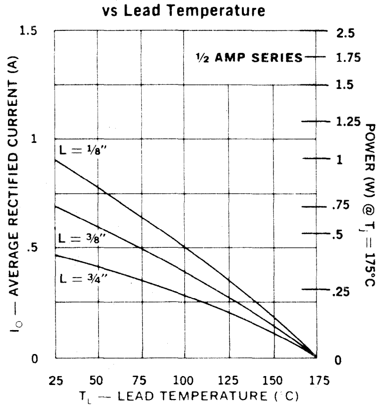
Maximum Current vs Lead Temperature



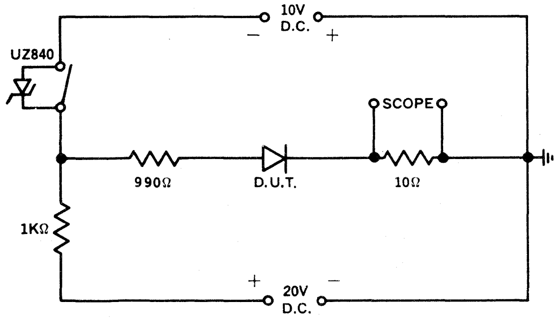
Maximum Current vs Lead Temperature



Maximum Current vs Lead Temperature



Reverse-Recovery Circuit



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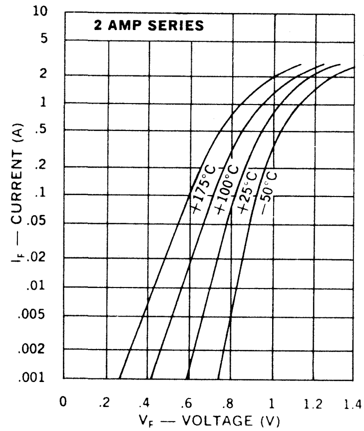
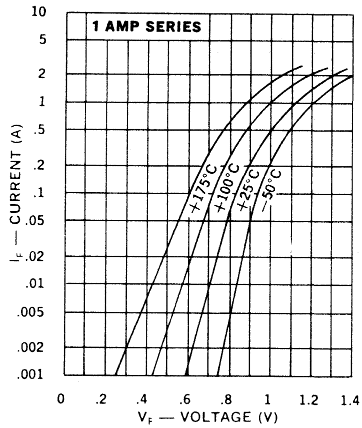
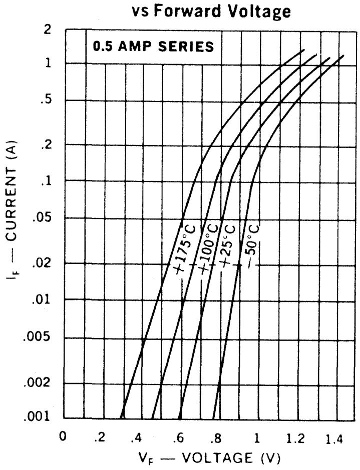
Typical Forward Current vs Forward Voltage



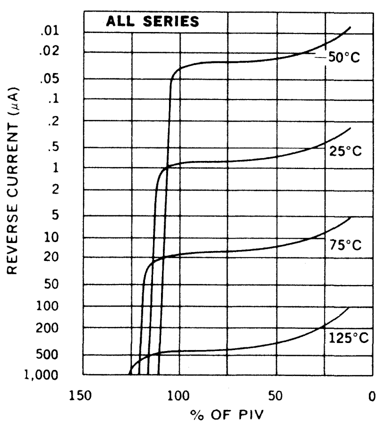
Typical Forward Current vs Forward Voltage



Typical Forward Current vs Forward Voltage



Typical Reverse Current vs PIV



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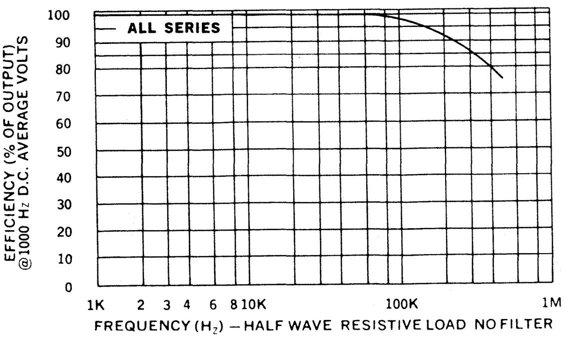
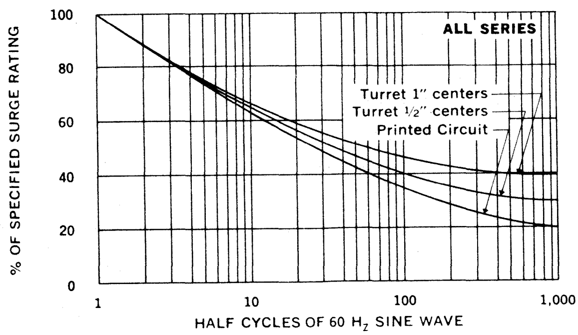
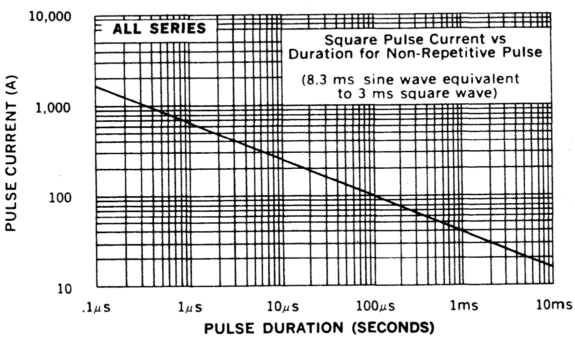
Efficiency vs Frequency at Rated Current (Sine Wave)



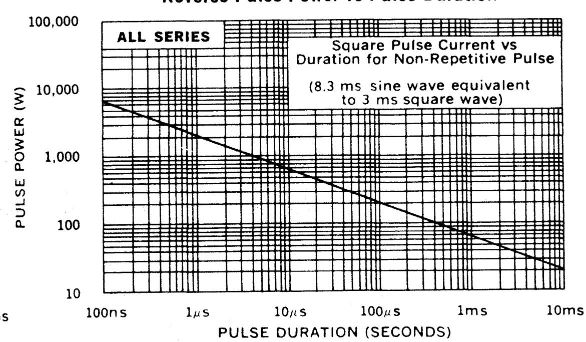
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



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RECTIFIERS

Fast Recovery, 2 Amp to 4 Amp

UTR2305-UTR2360
UTR3305-UTR3360
UTR4305-UTR4360

FEATURES

- Continuous Rating: to 4A
- Controlled Avalanche
- Surge Rating: to 100A
- PIV: to 600V
- Miniature Package

DESCRIPTION

Small size and high surge capability make this series of power switching rectifiers desirable for power supplies where size, weight and reliability are important.

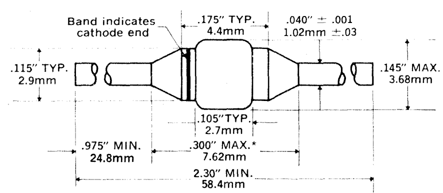
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	2 Amp Series	3 Amp Series	4 Amp Series
50V	UTR2305	UTR3305	UTR4305
100V	UTR2310	UTR3310	UTR4310
200V	UTR2320	UTR3320	UTR4320
400V	UTR2340	UTR3340	UTR4340
500V	UTR2350	UTR3350	UTR4350
600V	UTR2360	UTR3360	UTR4360

	2 AMP SERIES	3 AMP SERIES	4 AMP SERIES
Maximum Average D.C. Output Current			
@ $T_A = 25°C$	2.0A	3.0A	4.0A
@ $T_A = 100°C$	1.0A	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A	100A
Operating Temperature Range	−195°C to +175°C		
Storage Temperature Range	−195°C to +200°C		
Thermal Resistance	See lead temperature derating curve		

MECHANICAL SPECIFICATIONS

UTR4305-UTR4360 UTR3305-UTR3360 UTR2305-UTR2360



Part Identification: Green band indicates "UTR." Part number printed on body.

Polarity: Denoted by Green band.

Weight: 0.75 grams, typical.

BODY B

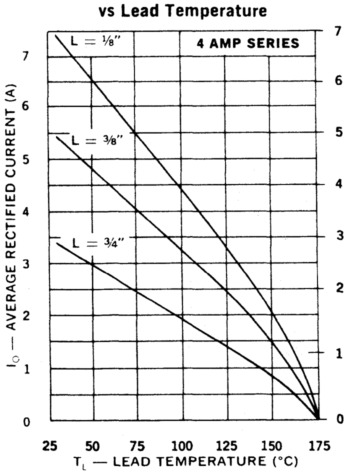
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

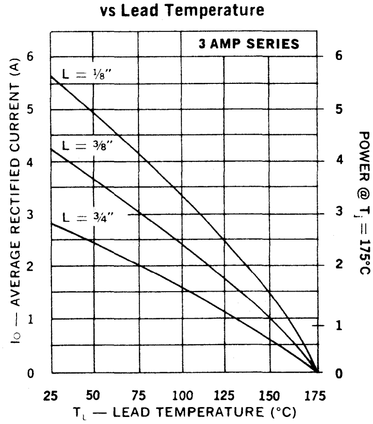
Type	PIV	Maximum Forward Voltage Drop	Maximum Leakage Current @ PIV		Maximum Reverse Recovery Time*	Maximum Junction Capacitance @ 25°C	
			25°C	100°C		0V	−10V
UTR4305	50V	1.1V @ 4A	5μA	100μA	250ns	600pf	240pf
UTR4310	100V				250ns	400pf	160pf
UTR4320	200V				250ns	320pf	128pf
UTR4340	400V				400ns	240pf	96pf
UTR4350	500V				400ns	200pf	80pf
UTR4360	600V				400ns	160pf	64pf
UTR3305	50V	1.1V @ 3A	5μA	100μA	250ns	600pf	240pf
UTR3310	100V				250ns	400pf	160pf
UTR3320	200V				250ns	320pf	128pf
UTR3340	400V				300ns	240pf	96pf
UTR3350	500V				350ns	200pf	80pf
UTR3360	600V				400ns	160pf	64pf
UTR2305	50V	1.1V @ 2A	5μA	100μA	250ns	600pf	240pf
UTR2310	100V				250ns	400pf	160pf
UTR2320	200V				250ns	320pf	128pf
UTR2340	400V				300ns	240pf	96pf
UTR2350	500V				350ns	200pf	80pf
UTR2360	600V				400ns	160pf	64pf

*Recovery time is measured from 1A to 1A recovering to 0.5A.

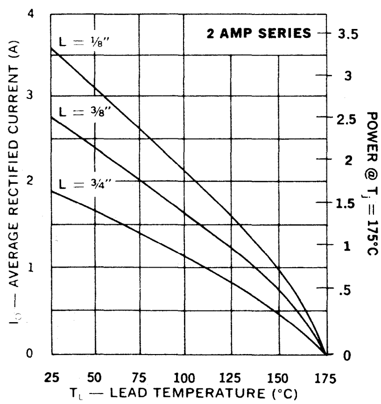
Maximum Current vs Lead Temperature



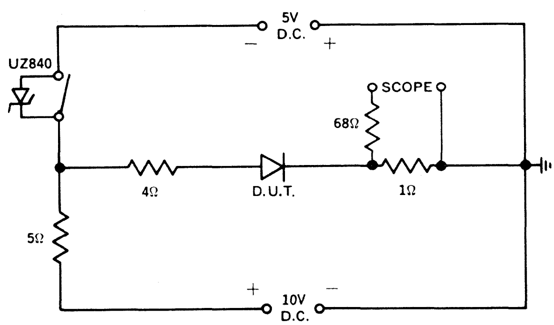
Maximum Current vs Lead Temperature



Maximum Current vs Lead Temperature



Reverse Recovery Circuit



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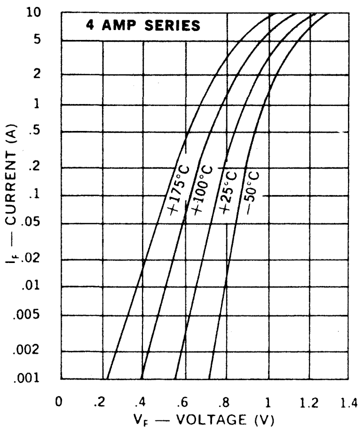
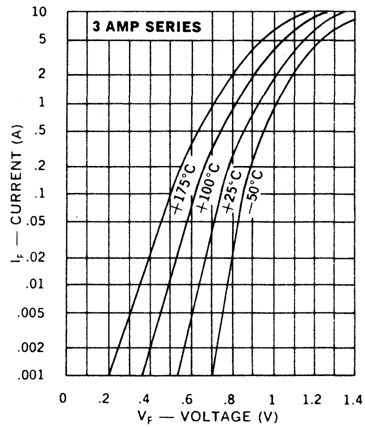
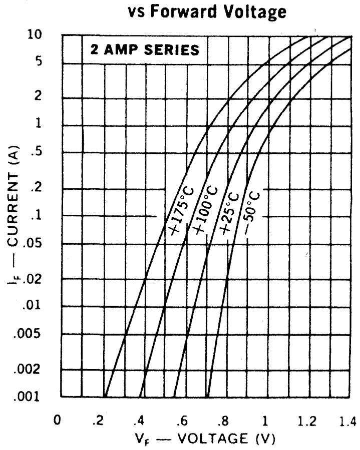
Typical Forward Current vs Forward Voltage



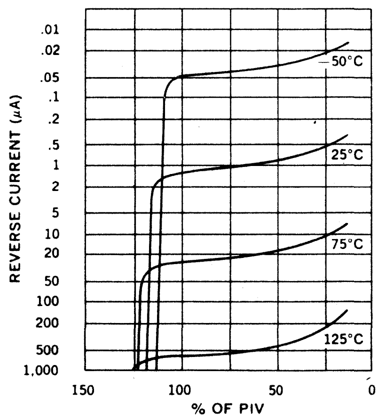
Typical Forward Current vs Forward Voltage



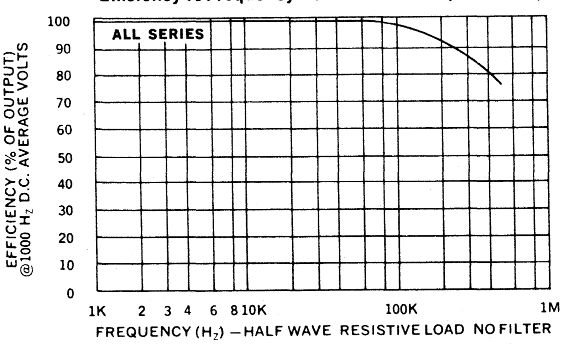
Typical Forward Current vs Forward Voltage



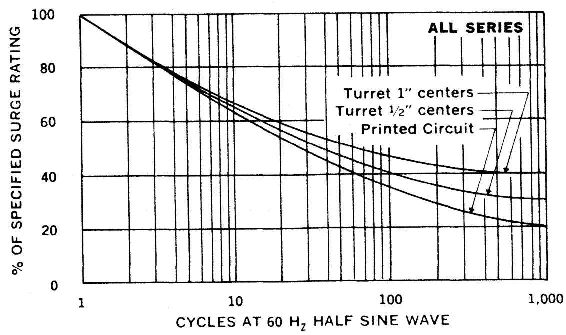
Typical Reverse Current vs PIV



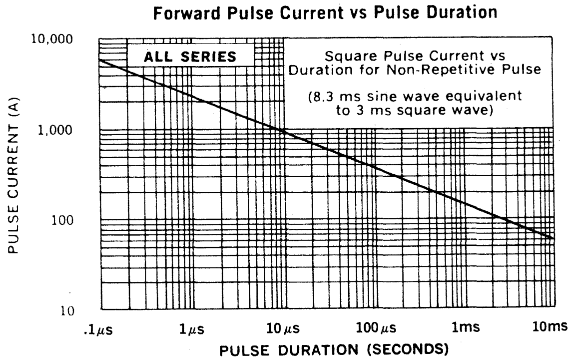
Efficiency vs Frequency at Rated Current (Sine Wave)



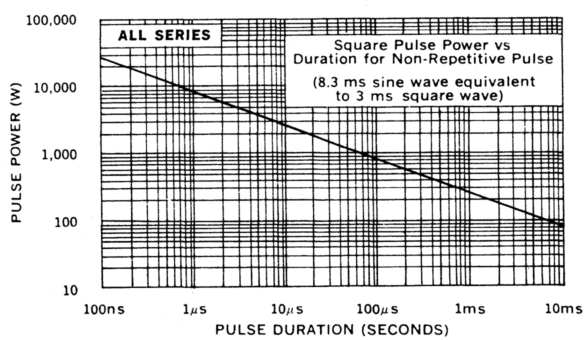
Allowable Forward Surge vs Number of Cycles



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



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RECTIFIERS
Fast Recovery, 6 Amp to 9 Amp

UTR4405-UTR4440
UTR5405-UTR5440
UTR6405-UTR6440

FEATURES
- Continuous Rating: to 9A
- Controlled Avalanche
- Surge Rating: to 150A
- Fast Recovery, 40kHz Operation
- PIV: to 400V
- Miniature Package

DESCRIPTION
The same basic construction as all Unitrode diodes, but using a miniature stud mounting and larger junction area, provides a 9 Amp continuous and 150 Amp surge rating in a package only one fifth the weight and one quarter the volume of conventional types.

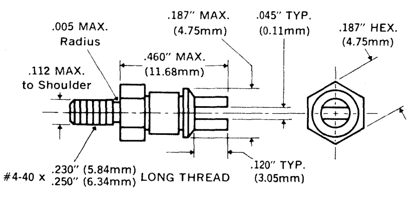
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	6 Amp Series	7.5 Amp Series	9 Amp Series
50V	UTR4405	UTR5405	UTR6405
100V	UTR4410	UTR5410	UTR6410
200V	UTR4420	UTR5420	UTR6420
400V	UTR4440	UTR5440	UTR6440

	6 AMP SERIES	7.5 AMP SERIES	9.0 AMP SERIES
Maximum Average D.C. Output Current @ $T_C = 100°C$	6.0A	7.5A	9.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	120A	135A	150A
Operating Temperature Range		−195°C to +175°C	
Storage Temperature Range		−195°C to +200°C	
Thermal Resistance		7.5°C/W	

MECHANICAL SPECIFICATIONS

UTR6405-UTR6440 UTR5405-UTR5440 UTR4405-UTR4440



Part Identification: Numerals and polarity letter indicate UTR type number, e.g., UTR 4405.

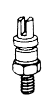
Polarity: Cathode to Stud is standard. Reverse polarity denoted by "R" suffix.

Finish: Metal parts gold plated per MIL-G-45204, Type II.

Weight: 1.5 grams, typical.

Also available with insulated stud.

BODY C — Stud Mount



Installation
Maximum unlubricated stud torque: 28 inch-ounces.
Insulating hardware supplied.
Do not use a screwdriver in the turret slot for installation purposes, or damage may result.

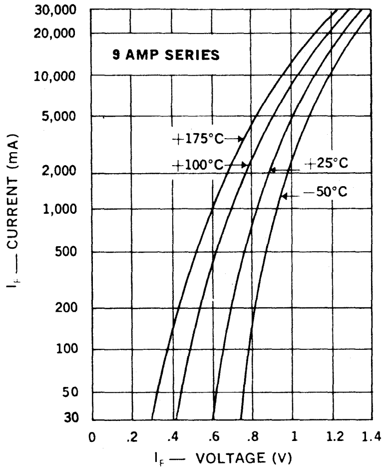
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

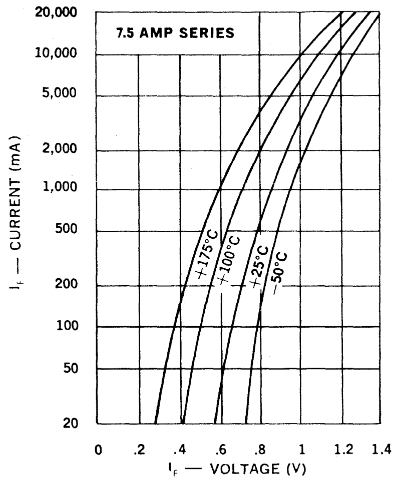
Type	PIV	Maximum Forward Voltage Drop	Maximum Reverse Current @ PIV 25°C	Maximum Reverse Current @ PIV 100°C	Maximum Reverse Recovery Time*
UTR6405	50V	1.1V @ 6.0A	10μA	300μA	300ns
UTR6410	100V				300ns
UTR6420	200V				400ns
UTR6440	400V				500ns
UTR5405	50V	1.1V @ 5.0A	10μA	300μA	300ns
UTR5410	100V				300ns
UTR5420	200V				400ns
UTR5440	400V				500ns
UTR4405	50V	1.1V @ 4.0A	10μA	300μA	300ns
UTR4410	100V				300ns
UTR4420	200V				400ns
UTR4440	400V				500ns

*Recovery time is measured from 1A to 1A, recovering to 0.5A.

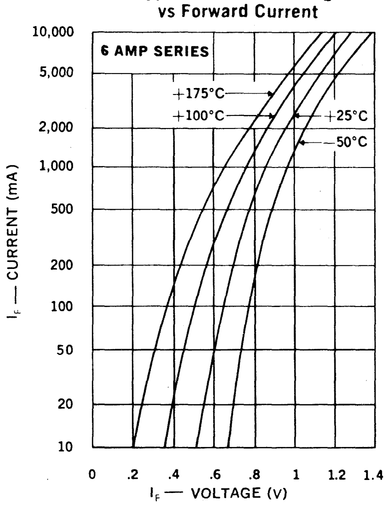
Typical Forward Voltage vs Forward Current



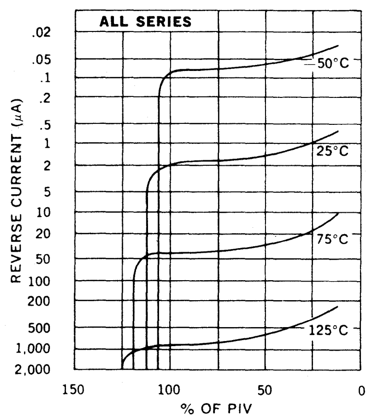
Typical Forward Voltage vs Forward Current



Typical Forward Voltage vs Forward Current



Typical Reverse Current vs PIV



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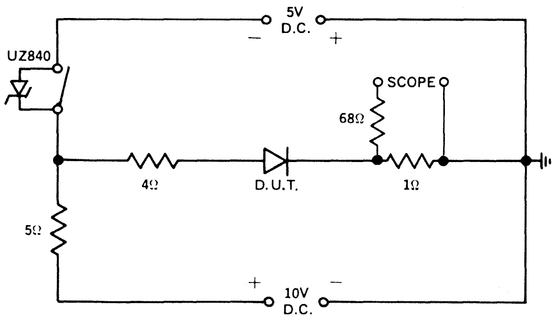
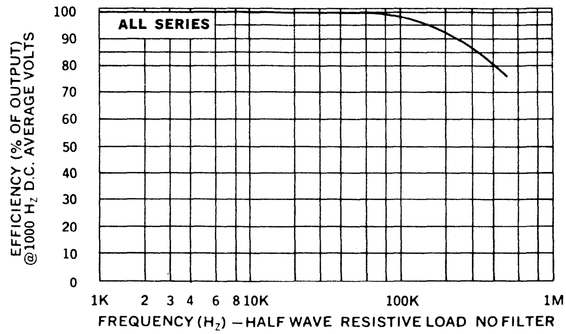
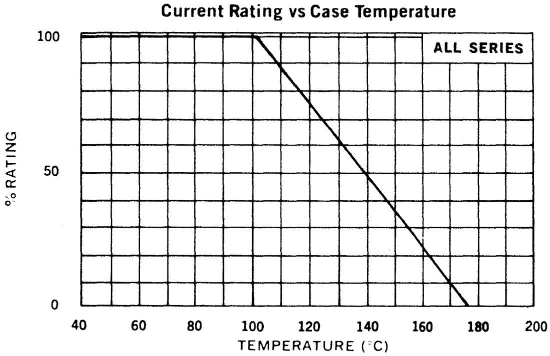
Reverse Recovery Circuit



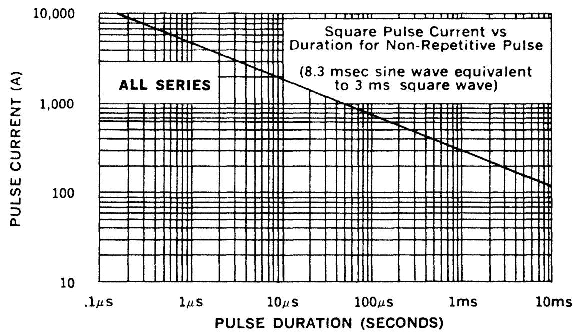
Efficiency vs Frequency at Rated Current (Sine Wave)



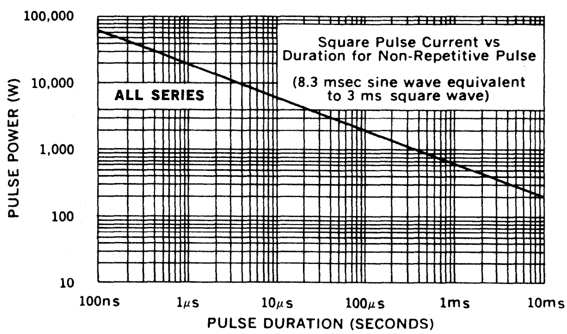
Current Rating vs Case Temperature



Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



RECTIFIERS

Ultra-Fast Recovery, 1 Amp and 2 Amp

UTX105-UTX125
UTX205-UTX225

FEATURES

- Continuous Rating: to 2A
- Controlled Avalanche
- Surge: to 25A
- Recovery Time less than 75ns
- Miniature Package

DESCRIPTION

These miniature ultra-fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz square wave. They may be used as half wave rectifiers or as legs of a bridge.

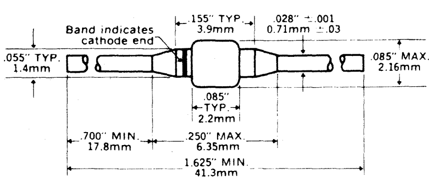
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	1 Amp Series	2 Amp Series
50V	UTX105	UTX205
100V	UTX110	UTX210
150V	UTX115	UTX215
200V	UTX120	UTX220
250V	UTX125	UTX225

	1 AMP SERIES	2 AMP SERIES
Maximum Average D.C. Output Current		
@ $T_A = 25°C$	1.0A	2.0A
@ $T_A = 100°C$	0.5A	1.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	20A	25A
Operating Temperature Range	—195°C to +175°C	
Storage Temperature Range	—195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UTX105-UTX125 UTX205-UTX225



Part Identification: Green band indicates "UTX." Part number printed on body.

Polarity: Denoted by green band.

Weight: 0.26 grams, typical.

BODY A

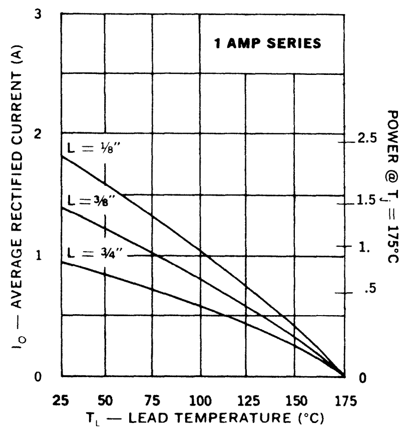
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

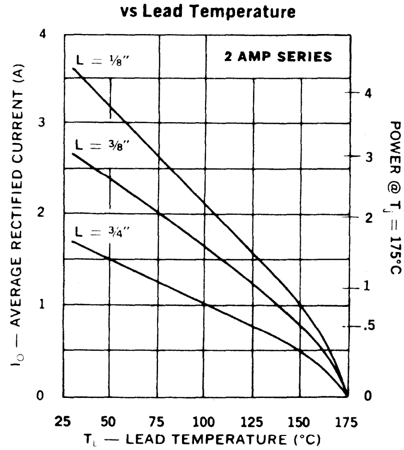
Type	PIV	Maximum Voltage Forward Drop	Leakage Current @ PIV 25°C	Leakage Current @ PIV 100°C	Max. Reverse Recovery Time*
UTX 205 UTX 210 UTX 215 UTX 220 UTX 225	50V 100V 150V 200V 250V	1.0V @ 1 Adc	3μA	50μA	75ns
UTX 105 UTX 110 UTX 115 UTX 120 UTX 125	50V 100V 150V 200V 250V	1.0V @ 0.5 Adc	3μA	50μA	75ns

*Recovery time is measured from 10.0mA to 10.0mA recovery to 5.0mA.

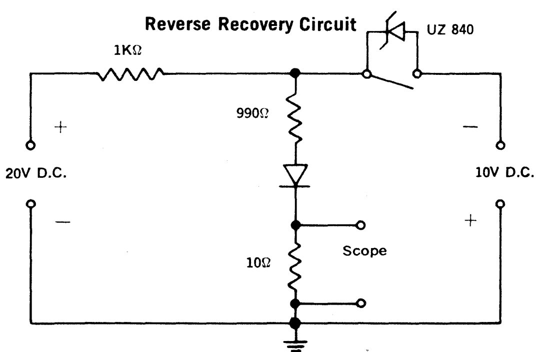
Maximum Current vs Lead Temperature



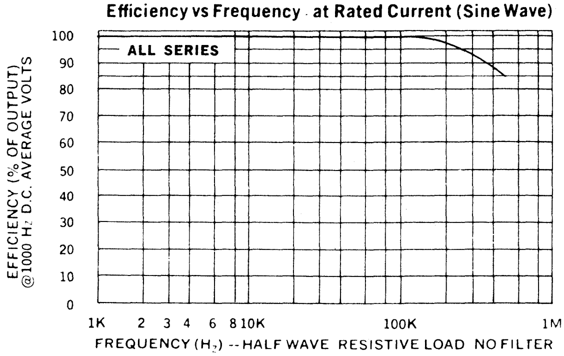
Maximum Current vs Lead Temperature



Reverse Recovery Circuit



Efficiency vs Frequency at Rated Current (Sine Wave)



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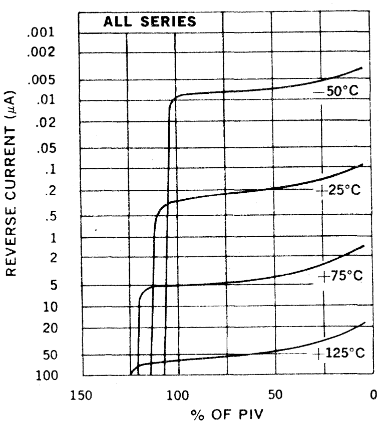
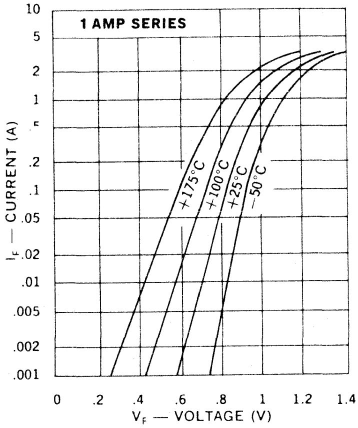
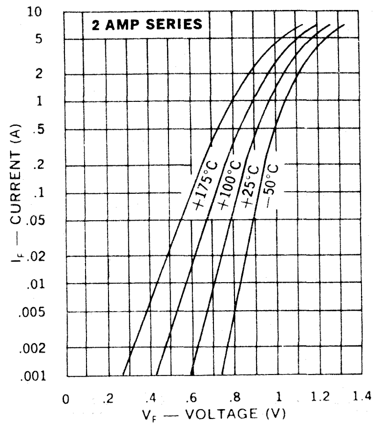
Typical Leakage Current vs. PIV



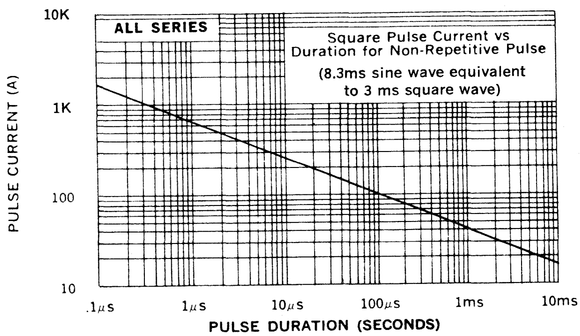
Typical Forward Current vs Forward Voltage



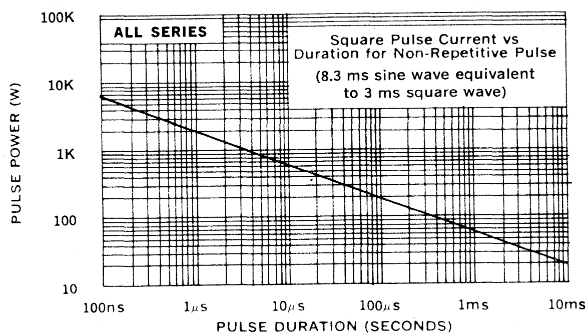
Typical Forward Current vs Forward Voltage



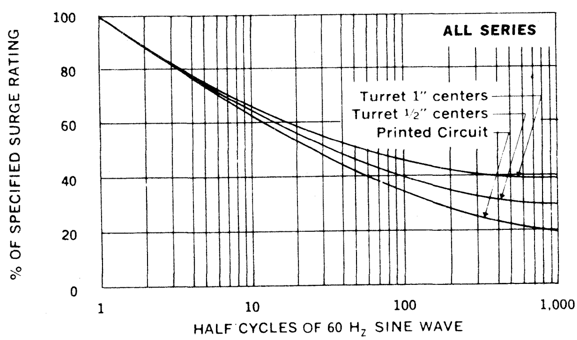
Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



Allowable Forward Surge vs Number of Cycles



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RECTIFIERS

Ultra-Fast Recovery, 3 Amp and 4 Amp

UTX 3105-UTX 3120
UTX 4105-UTX 4120

FEATURES

- Continuous Rating: to 4A
- Controlled Avalanche
- Surge: to 80A
- Recovery Time less than 100ns
- Miniature Package

DESCRIPTION

These miniature ultra-fast recovery rectifiers permit operation at full power at frequencies as high as 100kHz square wave. They have the same unique Unitrode construction as the familiar 2 amp UTX series, but are scaled up in size to provide higher continuous and surge current capability.

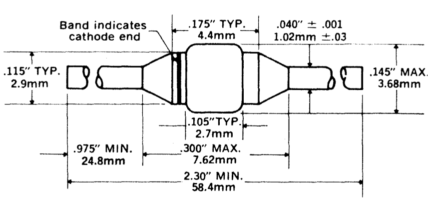
ABSOLUTE MAXIMUM RATINGS

Peak Inverse Voltage	3 Amp Series	4 Amp Series
50V	UTX 3105	UTX 4105
100V	UTX 3110	UTX 4110
150V	UTX 3115	UTX 4115
200V	UTX 3120	UTX 4120

	3 AMP SERIES	4 AMP SERIES
Maximum Average D.C. Output Current		
@ $T_A = 25°C$	3.0A	4.0A
@ $T_A = 100°C$	1.5A	2.0A
Non-Repetitive Sinusoidal Surge Current (8.3ms)	60A	80A
Operating Temperature Range	—195°C to +175°C	
Storage Temperature Range	—195°C to +200°C	
Thermal Resistance	See Lead Temperature Derating Curve	

MECHANICAL SPECIFICATIONS

UTX 3105-UTX 3120 UTX 4105-UTX 4120



UTX Prefix is identified by a Green Cathode Band

BODY B

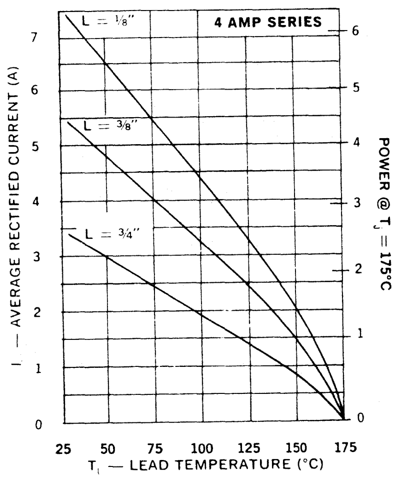
UNITRODE

ELECTRICAL SPECIFICATIONS (at 25°C unless noted)

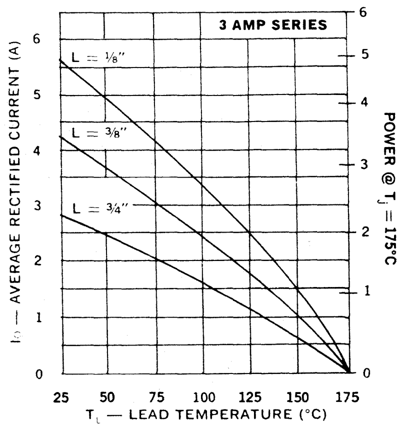
Type	PIV	Maximum Forward Voltage Drop*	Maximum Leakage Current @ PIV 25°C	Maximum Leakage Current @ PIV 100°C	Maximum Reverse Recovery Time**
UTX 4105 UTX 4110 UTX 4115 UTX 4120	50V 100V 150V 200V	1V @ 3 Adc	5μA	75μA	100ns
UTX 3105 UTX 3110 UTX 3115 UTX 3120	50V 100V 150V 200V	1V @ 2 Adc	5μA	75μA	100ns

*Forward voltage is measured at least 1 second after application of current.
**Recovery time is measured from 1A to 1A recovering to 0.5A.

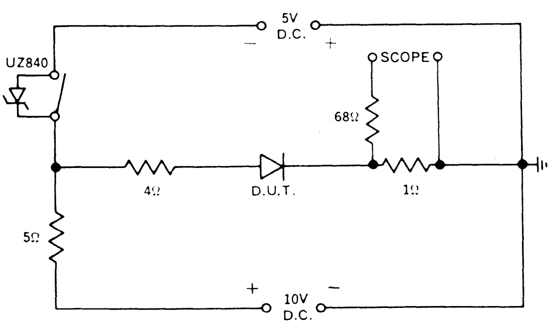
Maximum Current vs Lead Temperature



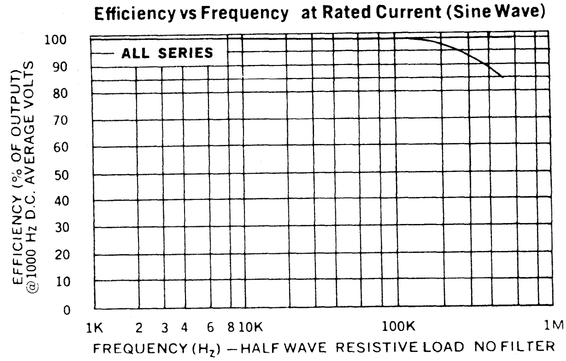
Maximum Current vs Lead Temperature



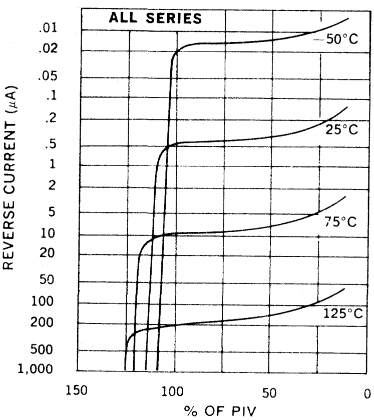
Reverse Recovery Circuit



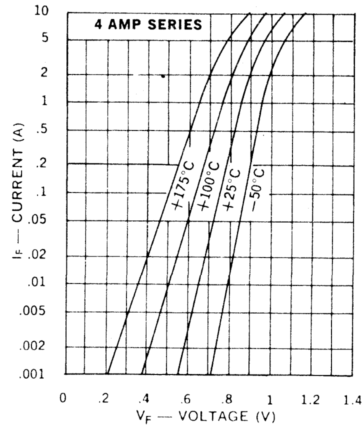
Efficiency vs Frequency at Rated Current (Sine Wave)



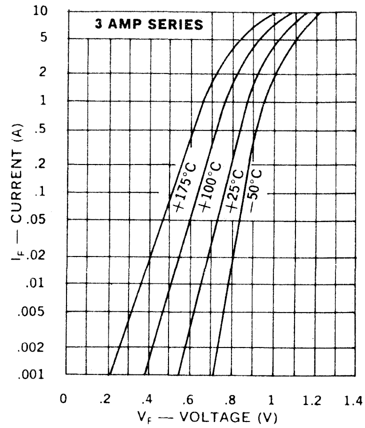
Typical Leakage Current vs PIV



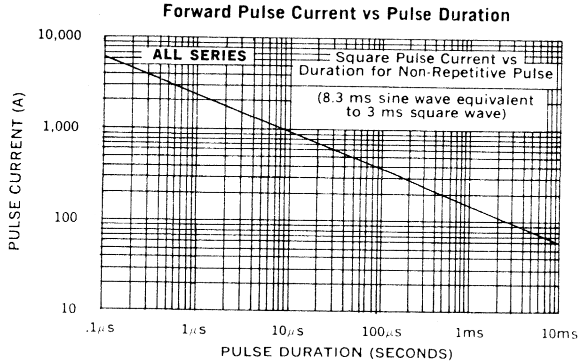
Typical Forward Current vs Forward Voltage



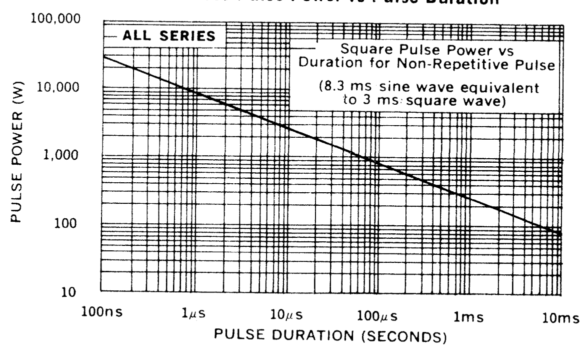
Typical Forward Current vs Forward Voltage



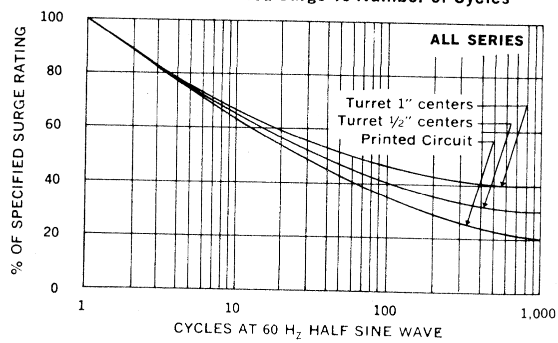
Forward Pulse Current vs Pulse Duration



Reverse Pulse Power vs Pulse Duration



Allowable Forward Surge vs Number of Cycles



POWER ZENERS
3 Watt

UZ706 SERIES
UZ806 SERIES

FEATURES
- 10 Times Greater Surge Rating than Conventional 1 Watt Types
- Small Physical Size

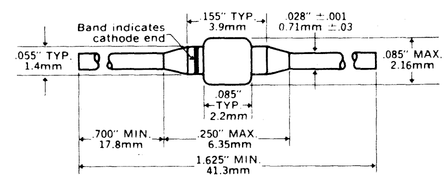
DESCRIPTION
Fused-in-glass metallurgically bonded 3 watt zener diodes.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 400V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

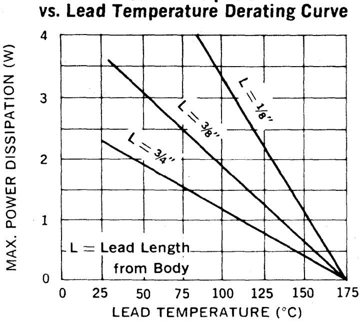
UZ706 SERIES UZ806 SERIES



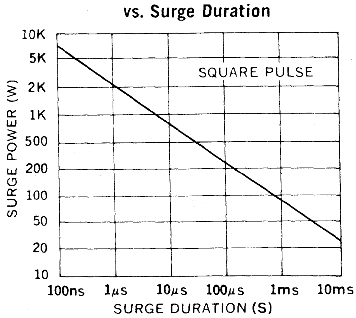
UZ Prefix is identified by a Blue or Red Cathode Band

BODY A

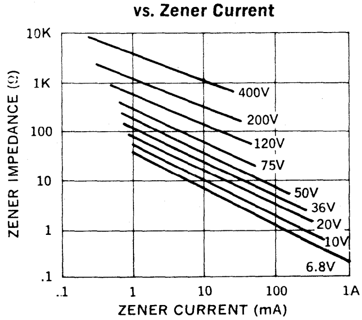
Power Dissipation vs. Lead Temperature Derating Curve



Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



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Type*		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current I_R @ V_R	± 5% V_R	± 10% V_R	Typ. Temp. Coefficient T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current‡ I_S
±5% Tolerance	Jedec** Registration	Volts	mA	Ohms	µA	Volts	Volts	%/°C	mA	Amps
UZ706	1N5063	6.8	75	2	500	5.2	4.9	.04	440	10.0
UZ707	1N5064	7.5	75	2	300	5.7	5.4	.04	400	8.0
UZ708	1N5065	8.2	75	3	200	6.2	5.9	.05	360	7.0
UZ709	1N5066	9.1	75	3	100	6.9	6.6	.05	330	6.0
UZ710	1N5067	10.0	75	4	40	7.6	7.2	.06	300	5.0
UZ712	1N4883	12	65	5	10	9.1	8.6	.07	250	4.0
UZ713	1N5069	13	50	6	10	9.9	9.3	.07	230	4.0
UZ714	1N5070	14	50	6	10	10.6	10.1	.07	210	4.0
UZ715	1N5071	15	50	6	10	11.4	10.8	.07	200	3.0
UZ716	1N5072	16	50	7	5	12.2	11.5	.07	185	3.0
UZ718	1N5073	18	40	8	5	13.7	12.9	.08	170	2.0
UZ720	1N4884	20	40	9	5	15.2	14.4	.08	150	2.0
UZ722	1N5074	22	30	10	5	16.7	15.8	.08	135	2.0
UZ724	1N5075	24	30	10	5	18.2	17.3	.08	125	1.5
UZ727	1N5076	27	25	12	1	20.6	19.4	.09	110	1.5
UZ730	1N5077	30	25	15	1	22.8	21.6	.090	100	1.5
UZ733	1N5078	33	20	21	1	25.1	23.7	.090	90	1.2
UZ736	1N5079	36	20	21	1	27.4	25.9	.090	85	1.0
UZ740	1N5081	40	20	27	1	30.4	28.8	.095	75	1.0
UZ745	1N5083	45	15	37	1	34.2	32.4	.095	65	0.8
UZ750	1N5085	50	15	50	1	38.0	36.0	.095	60	0.8
UZ756	1N5087	56	10	70	1	42.6	40.3	.095	55	0.7
UZ760	1N5088	60	10	70	1	45.7	43.2	.095	50	0.6
UZ770	1N5091	70	10	90	1	53.3	50.5	.095	45	0.6
UZ775	1N5092	75	10	100	1	56.0	54.0	.095	40	0.5
UZ780	1N5093	80	10	115	1	60.8	57.7	.095	35	0.4
UZ790	1N4096	90	8.0	150	1	68.5	64.8	.095	30	0.4
UZ110	1N4097	100	5.0	175	1	76.0	72.0	.100	30	0.4
UZ111	1N5096	110	5.0	250	1	83.6	79.2	.100	25	0.3
UZ112	1N5097	120	5.0	325	1	91.2	86.4	.100	25	0.2
UZ113	1N5098	130	5.0	375	1	98.8	93.6	.100	20	0.20
UZ114	1N5099	140	5.0	550	1	106	101	.100	20	0.20
UZ115	1N4098	150	5.0	650	1	114	108	.100	20	0.20
UZ116	1N5100	160	4.0	700	1	122	115	.100	20	0.15
UZ117	1N5101	170	4.0	750	1	129	122	.100	18	0.15
UZ118	1N5102	180	4.0	850	1	137	129	.100	18	0.10
UZ119	1N5103	190	4.0	900	1	144	137	.100	15	0.10
UZ120	1N5104	200	4.0	950	1	152	144	.100	15	0.10
UZ122	1N5105	220	3.0	1100	1	167	158	.100	15	0.09
UZ124	1N5106	240	3.0	1300	1	182	173	.105	12	0.09
UZ126	1N5107	260	3.0	1500	1	198	187	.105	12	0.08
UZ128	1N5109	280	3.0	1700	1	213	202	.105	10	0.08
UZ130	1N5110	300	3.0	1900	1	228	216	.105	10	0.07
UZ132	1N5111	320	2.0	2100	1	243	230	.105	9	0.07
UZ134	1N5113	340	2.0	2400	1	258	245	.110	9	0.06
UZ136	1N5114	360	2.0	2700	1	274	259	.110	8	0.06
UZ138	1N5115	380	2.0	3000	1	289	274	.110	8	0.06
UZ140	1N5117	400	2.0	3500	1	304	288	.110	7	0.06

* Specify 20% voltage tolerance by changing first numeral of type number from 7 to 9. (UZ709 becomes UZ909) or from 1 to 3 (UZ111 becomes UZ311).
Specify 10% voltage tolerance by changing first numeral of type number from 7 to 8. (UZ709 becomes UZ809) or from 1 to 2 (UZ111 becomes UZ211).

** Jedec registration applies to ±5% tolerance zeners only.

† All zener voltages are measured with an automated test set using a 35 ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★ Maximum current based on 3 watt rating. See lead temperature derating curves for proper mounting methods.

‡ Figures shown are for a peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

POWER ZENERS
5 Watt, Industrial

UZ4706 SERIES
UZ4806 SERIES

FEATURES
- 2 Times Greater Surge Rating than Plastic Types
- Small Physical Size
- Impervious to Moisture

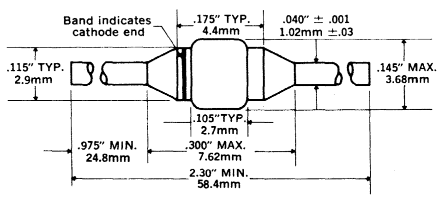
DESCRIPTION
Fused-in-glass 5 watt zeners with the same electrical specs as the 1N5342-1N5388 series.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 200V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	−65°C to +175°C

MECHANICAL SPECIFICATIONS

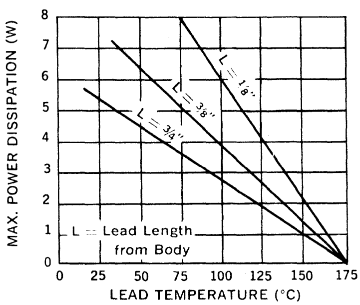
UZ4706 SERIES UZ4806 SERIES



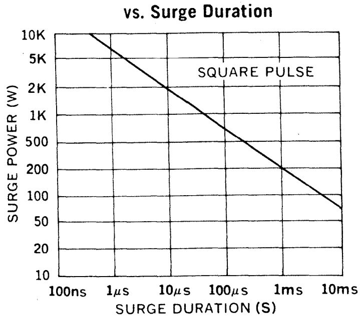
UZ Prefix is identified by a Blue or Red Cathode Band

BODY B

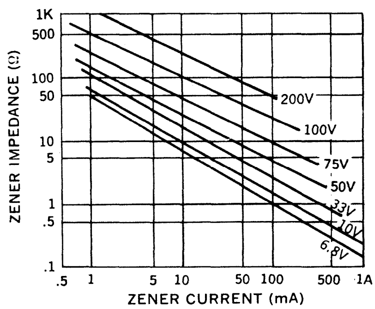
Power Dissipation vs. Lead Temperature Derating Curve



Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Type		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance §		Reverse Voltage			Maximum Cont. Current I_{ZM}	Maximum Surge Current ‡ I_S
				Z_Z @ I_{ZT}	Z_{ZK} @ I_{ZK} = 1mA	Maximum Leakage Current	@ Reverse Voltage ±10%	±5%		
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	Ohms	µA	Volts	Volts	mA	Amps
UZ4706	UZ4806	6.8	175	1	1000	500	4.9	5.2	675	32
UZ4707	UZ4807	7.5	175	1.5	800	400	5.4	5.7	620	26.5
UZ4708	UZ4808	8.2	150	1.5	600	200	5.9	6.2	570	19.2
UZ4709	UZ4809	9.1	150	2	400	100	6.6	6.9	510	17.6
UZ4710	UZ4810	10	125	2	125	75	7.2	7.6	470	16
UZ4712	UZ4812	12	100	2.5	140	50	8.6	9.1	385	14.4
UZ4713	UZ4813	13	100	3	145	25	9.3	9.9	350	12.8
UZ4715	UZ4815	15	75	3.5	150	15	10.8	11.4	300	9.6
UZ4716	UZ4816	16	75	3.5	155	10	11.5	12.2	275	8
UZ4718	UZ4818	18	65	4	160	10	12.9	13.7	255	7.2
UZ4720	UZ4820	20	65	4.5	165	10	14.4	15.2	220	6.4
UZ4722	UZ4822	22	50	5	170	10	15.8	16.7	195	5.6
UZ4724	UZ4824	24	50	5	175	10	17.3	18.2	180	5.2
UZ4727	UZ4827	27	50	6	180	10	19.4	20.6	155	4.8
UZ4730	UZ4830	30	40	8	190	10	21.6	22.8	140	4.4
UZ4733	UZ4833	33	40	10	200	5	23.7	25.1	130	4.0
UZ4736	UZ4836	36	30	11	220	5	25.9	27.4	120	3.6
UZ4739	UZ4839	39	30	14	230	5	28.1	29.7	105	3.2
UZ4743	UZ4843	43	30	20	240	5	31	32.7	100	2.8
UZ4747	UZ4847	47	25	25	250	5	33.8	35.8	96	2.6
UZ4751	UZ4851	51	25	27	270	5	36.7	38.8	85	2.4
UZ4756	UZ4856	56	20	35	320	5	40.3	42.6	81	2.2
UZ4762	UZ4862	62	20	42	400	5	44.6	47.1	73	2.0
UZ4768	UZ4868	68	20	50	500	5	49.0	51.7	61	1.8
UZ4775	UZ4875	75	20	55	620	5	54.0	56	60	1.6
UZ4782	UZ4882	82	15	80	720	5	59.0	62.2	55	1.4
UZ4791	UZ4891	91	15	90	760	5	65.5	69.2	50	1.3
UZ4110	UZ4210	100	12	100	800	5	72.0	76.0	45	1.1
UZ4111	UZ4211	110	12	125	1000	5	79.2	83.6	40	1.0
UZ4112	UZ4212	120	10	170	1150	5	86.4	91.2	38	.8
UZ4113	UZ4213	130	10	190	1250	5	93.6	98.8	35	.64
UZ4115	UZ4215	150	8	330	1500	5	108	114.0	31	.60
UZ4116	UZ4216	160	8	350	1650	5	115	121.6	30	.56
UZ4118	UZ4218	180	5	450	1750	5	129	136.8	25	.48
UZ4120	UZ4220	200	5	500	1850	5	144	152.0	22	.40

Maximum V_F @ 1.0 Amp = 1.2 Volts for all types

†All zener voltages are measured with an automated test set using a 35 ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

‡Figures shown are for peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

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POWER ZENERS
5 Watt

UZ5706 SERIES
UZ5806 SERIES

FEATURES
- 2 Times Greater Surge Rating than Conventional 10 Watt Zeners
- Small Physical Size

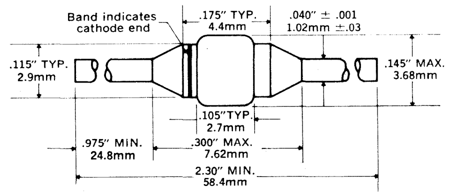
DESCRIPTION
Fused-in-glass, metallurgically-bonded 5 watt zeners.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 400V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

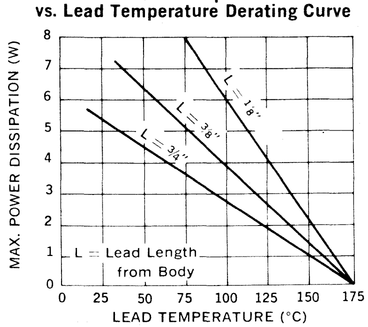
UZ5706 SERIES UZ5806 SERIES



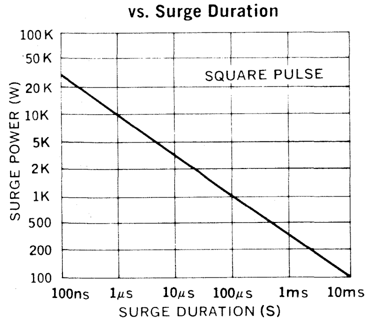
UZ Prefix is identified by a Blue or Red Cathode Band

BODY B

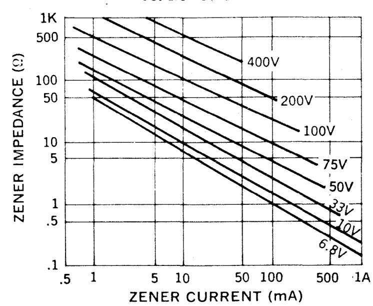
Power Dissipation vs. Lead Temperature Derating Curve



Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Type *		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current I_R	± 5% V_R	± 10% V_R	Typ. Temp. Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current ‡ I_S
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	µA	Volts	Volts	%/°C	mA	Amps
UZ5706	UZ5806	6.8	175	1.0	500	5.2	4.9	.05	675	40
UZ5707	UZ5807	7.5	175	1.5	400	5.7	5.4	.06	620	32
UZ5708	UZ5808	8.2	150	1.5	200	6.2	5.9	.06	570	24
UZ5709	UZ5809	9.1	150	2.0	100	6.9	6.6	.06	510	22
UZ5710	UZ5810	10.0	125	2.0	75	7.6	7.2	.07	470	20
UZ5712	UZ5812	12	100	2.5	50	9.1	8.6	.07	385	18
UZ5713	UZ5813	13	100	3.0	25	9.9	9.3	.08	350	16
UZ5714	UZ5814	14	100	3.0	20	10.6	10.1	.08	320	14
UZ5715	UZ5815	15	75	3.5	15	11.4	10.8	.08	300	12
UZ5716	UZ5816	16	75	3.5	10	12.2	11.5	.08	275	10
UZ5718	UZ5818	18	65	4.0	10	13.7	12.9	.085	255	9.0
UZ5720	UZ5820	20	65	4.5	10	15.2	14.4	.085	220	8.0
UZ5722	UZ5822	22	50	5.0	10	16.7	15.8	.085	195	7.0
UZ5724	UZ5824	24	50	5.0	10	18.2	17.3	.090	180	6.5
UZ5727	UZ5827	27	50	6.0	10	20.6	19.4	.090	155	6.0
UZ5730	UZ5830	30	40	8	10	22.8	21.6	.09	140	5.5
UZ5733	UZ5833	33	40	10	5	25.1	23.7	.09	130	5.0
UZ5736	UZ5836	36	30	11	5	27.4	25.9	.095	120	4.5
UZ5740	UZ5840	40	30	14	5	30.4	28.8	.095	105	4.0
UZ5745	UZ5845	45	30	20	5	34.2	32.4	.095	95	3.5
UZ5750	UZ5850	50	25	25	5	38.0	36.0	.095	85	3.0
UZ5756	UZ5856	56	20	35	5	42.6	40.3	.095	80	2.8
UZ5760	UZ5860	60	20	40	5	45.7	43.2	.100	75	2.5
UZ5770	UZ5870	70	20	50	5	53.3	50.5	.100	65	2.3
UZ5775	UZ5875	75	15	55	5	56.0	54.0	.100	60	2.0
UZ5780	UZ5880	80	15	80	5	60.8	57.7	.100	55	1.8
UZ5790	UZ5890	90	15	90	5	68.5	64.8	.100	50	1.6
UZ5110	UZ5210	100	10	100	5	76.0	72.0	.100	45	1.4
UZ5111	UZ5211	110	10	125	5	83.6	79.2	.100	40	1.2
UZ5112	UZ5212	120	10	170	5	91.2	86.4	.100	38	1.0
UZ5113	UZ5213	130	10	190	5	98.8	93.6	.105	35	0.80
UZ5114	UZ5214	140	8	230	5	106.0	101.0	.105	33	0.80
UZ5115	UZ5215	150	8	330	5	114.0	108.0	.105	31	0.75
UZ5116	UZ5216	160	8	350	5	122.0	115.0	.105	30	0.70
UZ5117	UZ5217	170	8	380	5	129.0	122.0	.105	27	0.65
UZ5118	UZ5218	180	5	450	5	137	129	.110	25	0.60
UZ5119	UZ5219	190	5	470	5	144	137	.110	24	0.55
UZ5120	UZ5220	200	5	500	5	152	144	.110	22	0.50
UZ5122	UZ5222	220	5	550	5	167	158	.115	20	0.45
UZ5124	UZ5224	240	5	650	5	182	173	.115	18	0.40
UZ5126	UZ5226	260	5	750	5	198	187	.120	17	0.35
UZ5128	UZ5228	280	4	850	5	213	202	.120	16	0.30
UZ5130	UZ5230	300	4	950	5	228	216	.120	15	0.25
UZ5132	UZ5232	320	4	1100	5	243	230	.120	14	0.24
UZ5134	UZ5234	340	4	1200	5	258	245	.120	13	0.23
UZ5136	UZ5236	360	3	1400	5	274	259	.120	12	0.22
UZ5138	UZ5238	380	3	1500	5	289	274	.120	12	0.21
UZ5140	UZ5240	400	3	1800	5	304	288	.120	11	0.20

Temperature Range: Operating and Storage −65°C to +175°C.

* Specify 20% tolerance by changing the second numeral of type number from 8 to 9 (UZ5809 becomes UZ5909) or from 2 to 3 (UZ5211 becomes UZ5311).

† All zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★ Maximum current based on 5 watt rating. See lead temperature derating curves for proper mounting methods.

‡ Figures shown are for a peak sinusoidal surge current of 8.3ms duration using 60 cycle AC. The 8.3ms square pulse rating is 71% of the value shown.

Several of the above types now have JEDEC 1N type numbers. The following cross-reference table lists the appropriate 1N numbers; specifications are same as above.

JEDEC #	UNITRODE TYPE	JEDEC #	UNITRODE TYPE	JEDEC #	UNITRODE TYPE
1N5118	UZ5714	1N5124	UZ5780	1N5130	UZ5128
1N5119	UZ5740	1N5125	UZ5790	1N5131	UZ5132
1N5120	UZ5745	1N5126	UZ5114	1N5132	UZ5134
1N5121	UZ5750	1N5127	UZ5117	1N5133	UZ5138
1N5122	UZ5760	1N5128	UZ5119	1N5134	UZ5140
1N5123	UZ5770	1N5129	UZ5126		

POWER ZENERS
6 Watt, Military, 10 Watt Military

UZ7706L and UZ7806L SERIES
UZ7706 and UZ7806 SERIES

FEATURES
- High Surge Rating
- Small Physical Size
- Leaded and Stud Packages Available

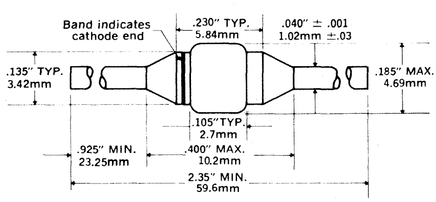
DESCRIPTION
Fused-in-glass, metallurgically bonded 6 watt leaded zeners and 10 watt stud-type zeners.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z		6.8 to 100V
Continuous Current		See Table
Surge Current (8.3ms)		See Table
Surge Power		See Graph
Power	UZ7706L & UZ7806L	See Lead Temperature Derating Curve
	UZ7706 & UZ7806 @100°C Case	10W
Storage and Operating Temperature		—65°C to +175°C

MECHANICAL SPECIFICATIONS

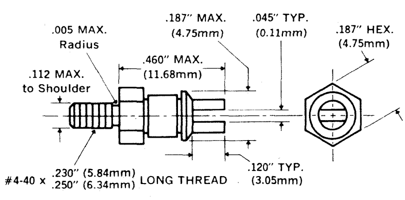
UZ7706L and UZ7806L SERIES



UZ Prefix is identified by a Blue or Red Cathode Band

BODY C — Lead Mount

UZ7706 and UZ7806 SERIES



POLARITY: Cathode to Stud is standard. Reverse polarity denoted by "R" suffix.

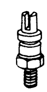
FINISH: Metal parts gold plated per MIL-G-45204, Type II.

WEIGHT: 1.5 grams (max.)

INSTALLATION PRECAUTIONS: Maximum unlubricated stud torque: 28 inch-ounces. Do not use a screwdriver in the turret slot for installation purposes, or damage may result.

UZ Prefix is identified by a Blue or Red Cathode Band

BODY C — Stud Mount



Type *		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current I_R @ V_R	± 5% V_R	± 10% V_R	Typ. Temp. Coeff. T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current ‡ I_S
±5% Tolerance	±10% Tolerance	Volts	mA	Ohms	μA	Volts	Volts	%/°C	mA	Amps
UZ7706	UZ7806	6.8	350	0.6	1000	5.2	4.9	.04	1350	50
UZ7707	UZ7807	7.5	325	0.7	800	5.7	5.4	.04	1250	41
UZ7708	UZ7808	8.2	300	0.8	200	6.2	5.9	.05	1150	31
UZ7709	UZ7809	9.1	275	1.0	150	6.9	6.6	.05	1020	29
UZ7710	UZ7810	10.0	250	1.0	100	7.6	7.2	.06	950	26
UZ7712	UZ7812	12	200	1.3	75	9.1	8.6	.07	770	23
UZ7713	UZ7813	13	200	1.5	50	9.9	9.3	.07	700	21
UZ7714	UZ7814	14	175	1.5	40	10.6	10.1	.07	640	20
UZ7715	UZ7815	15	150	2.0	30	11.4	10.8	.07	600	17
UZ7716	UZ7816	16	150	2.5	20	12.2	11.5	.07	550	15
UZ7718	UZ7818	18	130	3.5	20	13.7	12.9	.08	500	13
UZ7720	UZ7820	20	120	4.0	20	15.2	14.4	.08	440	12
UZ7722	UZ7822	22	100	4.5	20	16.7	15.8	.08	390	11
UZ7724	UZ7824	24	100	5.0	20	18.2	17.3	.08	360	10
UZ7727	UZ7827	27	90	6.0	20	20.6	19.4	.09	310	9
UZ7730	UZ7830	30	80	8	20	22.8	21.6	.090	280	8.5
UZ7733	UZ7833	33	70	10	10	25.1	23.7	.090	260	7.5
UZ7736	UZ7836	36	60	12	10	27.4	25.9	.090	240	7.0
UZ7740	UZ7840	40	60	15	10	30.4	28.8	.095	210	6.4
UZ7745	UZ7845	45	50	20	10	34.2	32.4	.095	180	5.5
UZ7750	UZ7850	50	50	22	10	38.0	36.0	.095	170	4.6
UZ7756	UZ7856	56	40	30	10	42.6	40.3	.095	160	4.1
UZ7760	UZ7860	60	40	35	10	45.6	43.2	.095	150	3.7
UZ7770	UZ7870	70	35	40	10	53.2	50.4	.095	130	3.3
UZ7775	UZ7875	75	30	45	10	56.0	54.0	.095	120	3.1
UZ7780	UZ7880	80	30	60	10	60.8	57.6	.095	110	2.9
UZ7790	UZ7890	90	25	75	10	68.4	64.8	.095	100	2.6
UZ7110	UZ7210	100	20	90	10	76.0	72.0	.100	90	2.3

Power Rating: Stud Mounted: 10 Watts at 100°C Case derate linerally to zero at 175°C Case.
Lead Mounted: See lead temperature derating curve.
Temperature Range: Operating and storage —65°C to 175°C.

* Specify 20% tolerance by changing the second numeral of type number from 8 to 9 (UZ7809 becomes UZ7909) or from 2 to 3 (UZ7210 becomes UZ7310). Specify leaded version by adding an L suffix (UZ7809 becomes UZ7809L).

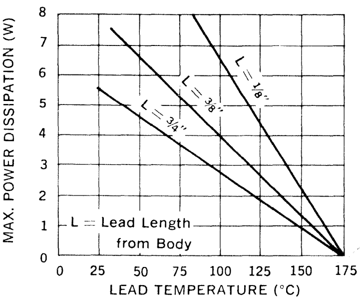
† All zener voltages are measured with an automated test set using a 35 msec test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§ Zener impedance is derived from the 60-cycle voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

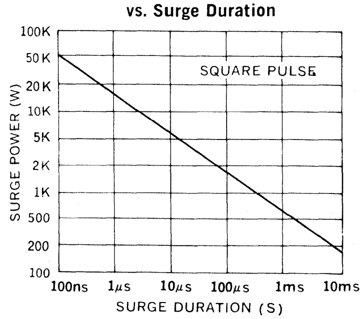
★ Ratings Based on 100°C Case temperature.

‡ **Figures shown are for a peak sinusoidal surge current of 8.3ms duration, non-repetitive. The 8.3ms square pulse rating is 71% of the value shown.**

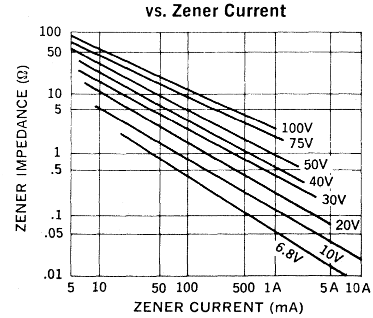
Power Dissipation vs. Lead Temperature Derating Curve



Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



POWER ZENERS
1 Watt, Industrial

UZ8706 SERIES
UZ8806 SERIES

FEATURES
- High Surge Ratings
- A Quarter the Size of Conventional 1 Watt Zeners
- Impervious to Moisture

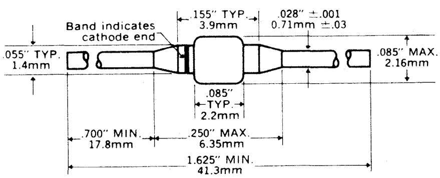
DESCRIPTION
One watt zener diodes, hermetically sealed in glass.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 200V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

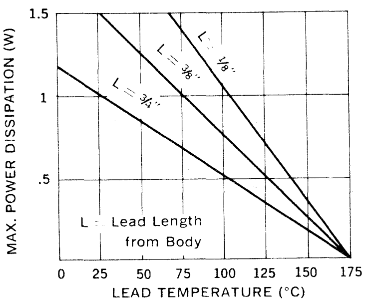
UZ8706 SERIES UZ8806 SERIES



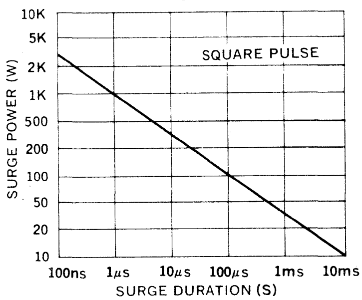
UZ Prefix is identified by a Blue or Red Cathode Band

BODY A

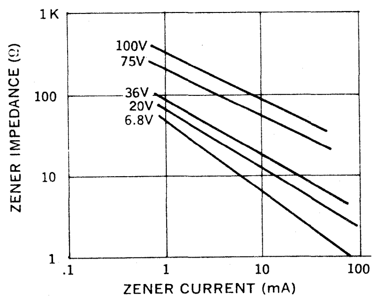
Power Dissipation vs. Lead Temperature Derating Curve



Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

Type		Electrical Specifications at 25°C							Maximum Ratings	
		Nominal Zener Voltage †	Test Current	Max. Zener Impedance §	Maximum Reverse Leakage Current			Typ. Temp. Coefficient	Maximum Continuous Current ★	Maximum Surge Current ‡
						± 5%	± 10%			
		V_Z @ I_{ZT}	I_{ZT}	Z_Z @ I_{ZT}	I_R @ V_R	V_R	V_R	T.C. @ I_{ZT}	I_{ZM}	I_S
± 5% Tolerance	± 10% Tolerance	Volts	mA	Ohms	μA	Volts	Volts	%/°C	mA	Amps
UZ 8706	UZ 8806	6.8	37	3.5	50	5.2	4.9	0.04	140	5.00
UZ 8707	UZ 8807	7.5	34	4.0	30	5.7	5.4	0.04	125	4.50
UZ 8708	UZ 8808	8.2	31	4.5	10	6.2	5.9	0.05	115	3.90
UZ 8709	UZ 8809	9.1	28	5.0	3.0	6.9	6.6	0.05	105	3.37
UZ 8710	UZ 8810	10	25	7.0	2.0	7.6	7.2	0.06	95	2.77
UZ 8712	UZ 8812	12	23	9.0	1.0	9.1	8.6	0.07	85	2.25
UZ 8713	UZ 8813	13	21	10	0.5	9.9	9.3	0.07	80	2.25
UZ 8714	UZ 8814	14	19	12	0.5	10.6	10.1	0.07	74	2.25
UZ 8715	UZ 8815	15	17	14	0.5	11.4	10.8	0.07	63	1.65
UZ 8716	UZ 8816	16	15.5	16	0.5	12.1	11.5	0.07	60	1.65
UZ 8718	UZ 8818	18	14.0	20	0.5	13.7	12.9	0.08	52	1.12
UZ 8720	UZ 8820	20	12.5	22	0.5	15.2	14.4	0.08	47	1.12
UZ 8722	UZ 8820	22	11.5	23	0.5	16.7	15.8	0.08	43	1.12
UZ 8724	UZ 8824	24	10.5	25	0.5	18.2	17.3	0.08	40	0.825
UZ 8727	UZ 8827	27	9.5	35	0.5	20.5	19.4	0.09	35	0.825
UZ 8730	UZ 8830	30	8.5	40	0.5	22.8	21.6	0.09	31	0.825
UZ 8733	UZ 8833	33	7.5	45	0.5	25.1	23.7	0.09	28	0.675
UZ 8736	UZ 8836	36	7.0	50	0.5	27.3	25.9	0.09	26	0.562
UZ 8740	UZ 8840	40	6.5	62	0.5	30.4	28.8	0.095	24	0.562
UZ 8745	UZ 8845	45	6.0	75	0.5	34.2	32.4	0.095	22	0.450
UZ 8750	UZ 8850	50	5.0	85	0.5	38.0	36.0	0.095	20	0.450
UZ 8756	UZ 8856	56	4.5	110	0.5	42.5	40.3	0.095	17	0.390
UZ 8760	UZ 8860	60	4.0	125	0.5	45.6	43.2	0.095	15	0.337
UZ 8770	UZ 8870	70	3.7	150	0.5	53.2	50.4	0.095	14	0.337
UZ 8775	UZ 8875	75	3.3	175	0.5	57.0	54.0	0.095	12	0.277
UZ 8780	UZ 8880	80	3.0	200	0.5	60.8	57.6	0.095	11	0.225
UZ 8790	UZ 8890	90	2.8	250	0.5	68.4	64.8	0.095	10	0.225
UZ 8110	UZ 8210	100	2.5	350	0.5	76.0	72.0	0.10	9.5	0.225
UZ 8111	UZ 8211	110	2.3	450	0.5	83.6	79.2	0.10	8.5	0.165
UZ 8112	UZ 8212	120	2.0	550	0.5	91.2	86.4	0.10	8.0	0.112
UZ 8113	UZ 8213	130	1.9	700	0.5	98.8	93.6	0.10	7.2	0.112
UZ 8114	UZ 8214	140	1.8	850	0.5	106	100	0.10	6.8	0.112
UZ 8115	UZ 8215	150	1.7	1000	0.5	114	108	0.10	6.3	0.112
UZ 8116	UZ 8216	160	1.6	1100	0.5	121	115	0.10	5.9	0.082
UZ 8117	UZ 8217	170	1.5	1200	0.5	129	122	0.10	5.6	0.082
UZ 8118	UZ 8218	180	1.4	1300	0.5	137	129	0.10	5.2	0.056
UZ 8119	UZ 8219	190	1.3	1400	0.5	144	137	0.10	5.0	0.056
UZ 8120	UZ 8220	200	1.2	1500	0.5	152	144	0.10	4.7	0.056

†All zener voltages are measured with an automated test set using a 35 millisecond test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

§Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★Ratings are based on free air. T_A is 25°C. For use at 1.5 watts see derating curve.

‡Figures shown are for a peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3 ms square pulse rating is 71% of the value shown.

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POWER ZENER/TRANSIENT VOLTAGE SUPPRESSOR
3 Watt, Industrial

UZS306 SERIES

FEATURES
- 3 Watts steady-state power dissipation and 150 Watts for 1ms
- One picosecond transient response time
- Miniature glass encased hermetically sealed package
- Repeatable performance and high surge handling capability under sustained transient conditions.

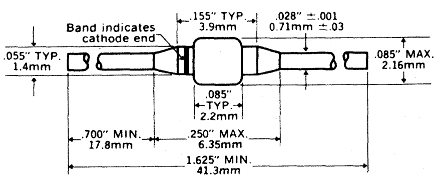
DESCRIPTION
3 watt zener diodes, hermetically sealed in glass.

ABSOLUTE MAXIMUM RATINGS

Zener Voltage, V_Z	6.8 to 400V
Continuous Current	See Table
Surge Current (8.3ms)	See Table
Surge Power	See Graph
Power	See Lead Temperature Derating Curve
Storage and Operating Temperature	—65°C to +175°C

MECHANICAL SPECIFICATIONS

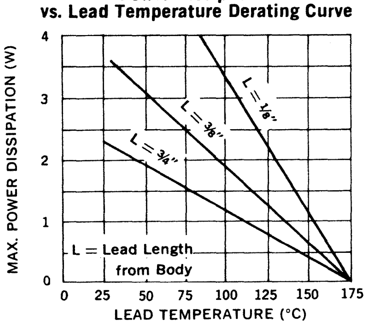
UZS306 SERIES



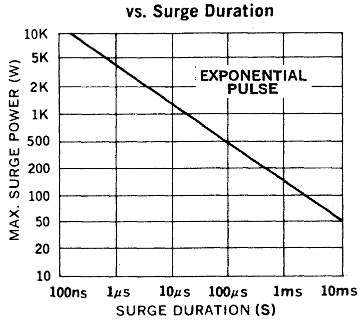
UZ Prefix is identified by a Blue Cathode Band

BODY A

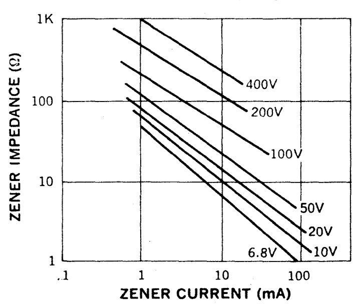
Power Dissipation vs. Lead Temperature Derating Curve



Typical Surge Power vs. Surge Duration



Typical Zener Impedance vs. Zener Current



UNITRODE

* Type	Electrical Specifications at 25°C						Maximum Ratings		TVS Ratings	
	Nominal Zener Voltage † V_Z @ I_{ZT}	Test Current I_{ZT}	Max. Zener Impedance § Z_Z @ I_{ZT}	Maximum Reverse Leakage Current I_R @ V_R	Maximum Reverse Leakage Current ±5% V_R	Typ. Temp. Coefficient T_C @ I_{ZT}	Maximum Continuous Current ★ I_{ZM}	Maximum Surge Current ‡ I_S	Typical Peak Pulse Current I_{PP}**	Typical Peak Clamping Voltage V_C**
±5% Tolerance	Volts	mA	Ohms	μA	Volts	%/°C	mA	Amps	Amps	Volts
UZS306	6.8	75	2	50	5.2	.04	440	10.0	17	8.7
UZS307	7.5	75	2	30	5.7	.04	400	8.0	15	9.8
UZS308	8.2	75	3	10	6.2	.05	360	7.0	13	11.2
UZS309	9.1	75	3	5	6.9	.05	330	6.0	12	12.7
UZS310	10.0	75	4	3	7.6	.06	300	5.0	10	14.0
UZS312	12	65	5	1	9.1	.07	250	4.0	8.9	16.8
UZS313	13	50	6	1	9.9	.07	230	4.0	8.2	18.2
UZS314	14	50	6	1	10.6	.07	210	4.0	7.6	19.6
UZS315	15	50	6	1	11.4	.07	200	3.0	7.1	21.0
UZS316	16	50	7	1	12.2	.07	185	3.0	6.7	22.4
UZS318	18	40	8	1	13.7	.08	170	2.0	5.9	25
UZS320	20	40	9	1	15.2	.08	150	2.0	5.4	28
UZS322	22	30	10	1	16.7	.08	135	2.0	4.9	31
UZS324	24	30	10	1	18.2	.08	125	1.5	4.5	34
UZS327	27	25	12	1	20.6	.09	110	1.5	3.9	38
UZS330	30	25	15	1	22.8	.090	100	1.5	3.6	42
UZS333	33	20	21	1	25.1	.090	90	1.2	3.2	46
UZS336	36	20	21	1	27.4	.090	85	1.0	3.0	50
UZS339	39	20	26	1	29.6	.095	75	1.0	2.7	55
UZS343	43	15	35	1	32.7	.095	65	0.9	2.5	61
UZS347	47	15	39	1	35.7	.095	65	0.8	2.3	65
UZS351	51	15	50	1	38.8	.095	60	0.8	2.1	71
UZS356	56	10	50	1	42.6	.095	55	0.7	1.9	78
UZS375	75	10	50	1	57.0	.095	40	0.5	1.4	105
UZS410	100	5.0	90	1	76.0	.100	30	0.4	1.1	140
UZS420	200	4.0	475	1	152	.100	15	0.10	0.55	275
UZS426	260	3.0	750	1	198	.105	12	0.08	0.42	355
UZS428	280	3.0	850	1	213	.105	10	0.08	0.39	380
UZS440	400	2.0	1800	1	304	.110	7	0.06	0.28	545

* Specify 10% voltage tolerance by changing first numeral of type number from 3 to 5 (UZS309 becomes UZS509) or from 4 to 6 (UZS410 becomes UZS610).

† All zener voltages are measured with an automated test using a 35 ms test time. Longer or shorter test times will have a corresponding effect on the measured value due to heating effects.

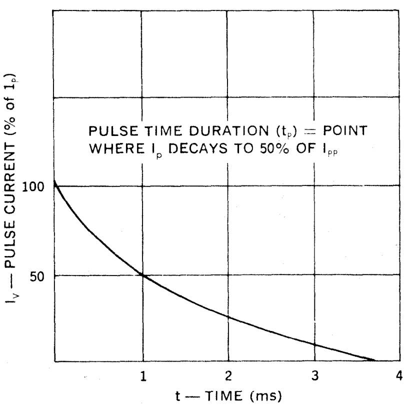
§ Zener impedance is derived from the 60-cycle AC voltage created when AC current with RMS value of 10% of DC zener test current is superimposed on the test current.

★ Maximum current based on 3 watt rating. See lead temperature derating curves for proper mounting methods.

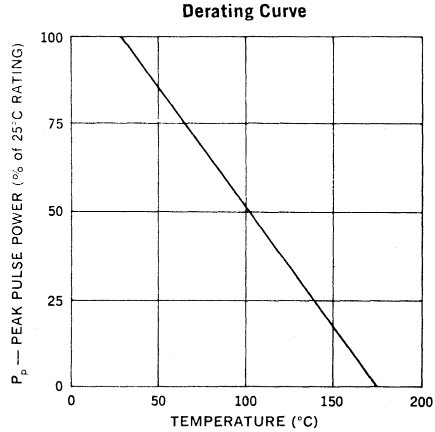
‡ Figures shown are for a peak sinusoidal surge current of 8.3 ms duration using 60 cycle AC. The 8.3 ms square pulse rating is 71% of the value shown.

** Typical peak pulse current and clamping voltage based on exponential input pulse current which has decayed to 50% of peak value at end of 1 millisecond duration.

Pulse Waveform



Derating Curve



VI. RELIABILITY PROCESSING

HR-201 SCREENING

Unitrode semiconductors are inherently high-reliability devices; however, some users may want the ultimate assurance of reliability. The HR-201 screening specification is intended to satisfy this need. It should be emphasized that, although these tests are not likely to stress a Unitrode device to failure, they are recommended for those applications which require extreme degrees of reliability assurance — such as man-rated space vehicles, special weapons systems, or other critical applications.

Specific screening specifications and the products to which they are applicable follow:

Product	Specification	Specification with Delta's
Rectifiers	HR201	HR201-D
Zeners	HR201Z	HR201Z-D
Surge Suppressors	HR201S	HR201S-D
Transistors	HR201T	
Switching Regulators	UL101T1 & T3*	UL101T3*
	UL102T1 & T3*	UL101T3*

*Includes lot qualification

All units are subject to 100% screening tests per above specifications as follows:

1. **Reverse Bias Operation** — Full rated PIV for rectifiers and switching regulators (80% of minimum voltage for zeners and surge suppressors; 80% of V_{CEO} for transistors) applied for 168 hours at 125°C. Temperature is then reduced to 25°C over a period of not less than one hour with full voltage maintained.
2. **Thermal Fatigue** — Ten cycles. Each cycle consists of 15 minutes at 200°C ambient, immediate transfer to —65°C ambient for 15 minutes, and immediate return to 200°C. For switching regulator temperature extremes are —55°C to 150°C.
3. **Case Integrity** — 100 p.s.i. is applied while submerged in a fluorescent dye such as Zygol ZL-1C for 30 minutes. After rinsing in clear water, the device is examined under ultraviolet light for evidence of a defective seal. For switching regulator, helium and fluorocarbon test methods are used.
4. **Power Operation**
   Rectifiers — Each rectifier is subjected to 5 seconds overload current as follows:
   2A through 0.75A rated, Body A — 5 Adc applied
   4A through 2A rated, Body B — 8 Adc applied
   12A through 7.5A rated, Body C — 8 Adc applied
   Zeners — Each zener diode is subjected to 168 hours of direct current operation in avalanche at $T_A = 25°C$ with sufficient power to raise the junction temperature to 175°C.
   Surge Suppressors — Each device is subjected to 10 pulses at the rate of one pulse per minute at 25°C at rated surge current.
   Transistors — Each device is operated at rated power at 25°C ambient for 168 hours.
   In each of above situations, the device is mounted on 1-inch center clips.
   Switching Regulators — Each device is operated in a pulse circuit at rated free air power rating for 40 hrs.
5. **Room Temperature Measurements** — All parameters are measured to ensure conformance with specification. All diodes are 100% oscilloscope-tested to ensure controlled-avalanche characteristics. Any parts exceeding specified limits or exhibiting unusual characteristics are removed from the lot.

JANTX, and JANTXV DEVICES — A number of rectifiers, zeners, transistors, and SCRs plus some rectifier assemblies and surge suppressors are available with JANTX and JANTXV screening and visual inspections. See the JAN page in the Product Selection Guide, that lists all of Unitrode's qualifications.

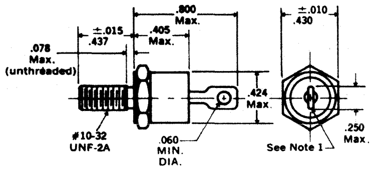
HIGH RELIABILITY SEMICONDUCTOR REPORT

Unitrode's High Reliability Semiconductor Report is available upon request. Device design, failure modes, environmental tests and their effects, and stress screening are all presented. A summary of failure rate data is given, as is list of major programs and systems in which Unitrode devices have been used.

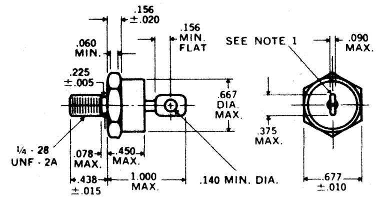
VII. MECHANICAL SPECIFICATIONS

MECHANICAL SPECIFICATIONS

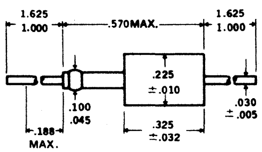
DO-4



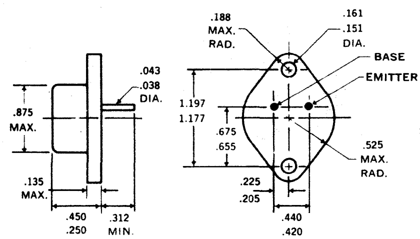
DO-5



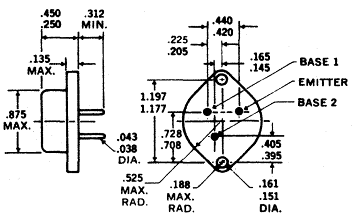
DO-13



TO-3

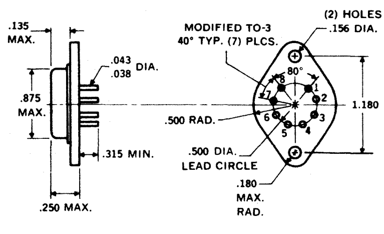


TO-3 (3 PIN)

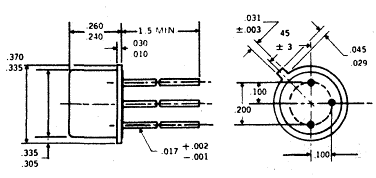


COLLECTOR CONNECTED TO CASE

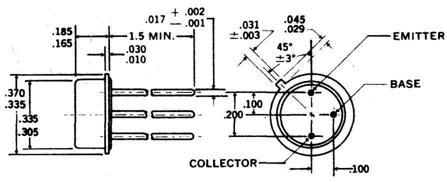
TO-3 (8 PIN)



TO-5



Pancake TO-5



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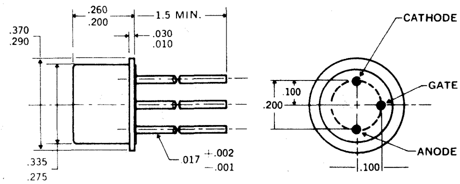
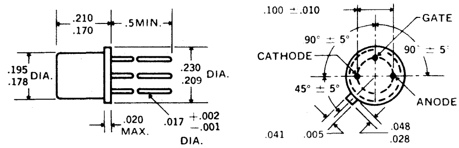
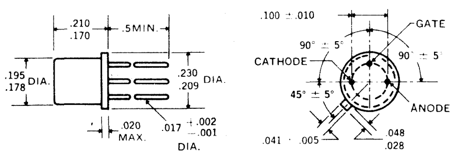
TO-9



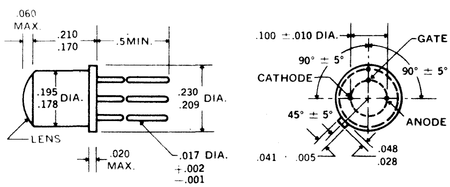
TO-18



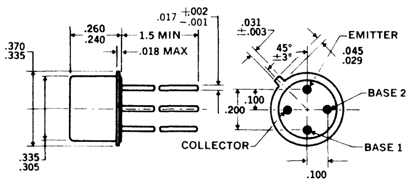
TO-18 (FLAT LENS) (PF)



TO-18 (ROUND LENS) (PR)

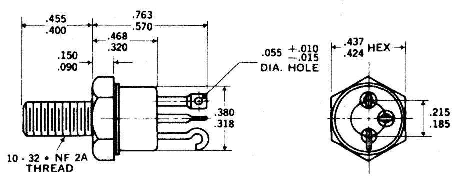


TO-33

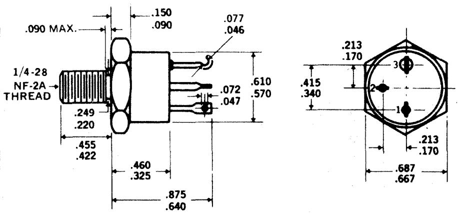


COLLECTOR CONNECTED TO CASE

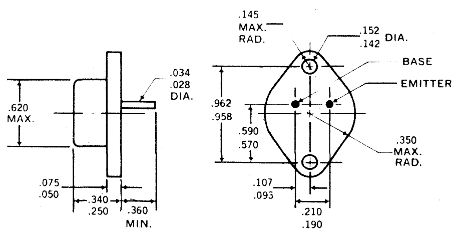
TO-59



TO-61



TO-66



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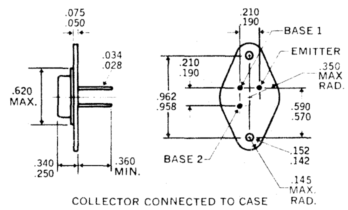
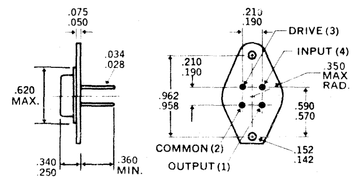
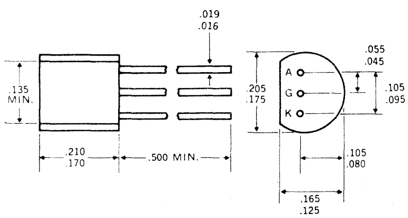
TO-66 (3 PIN)



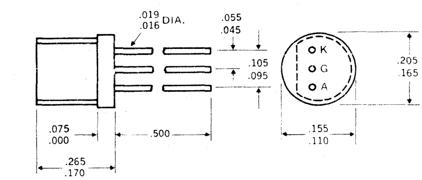
TO-66 (4 PIN)



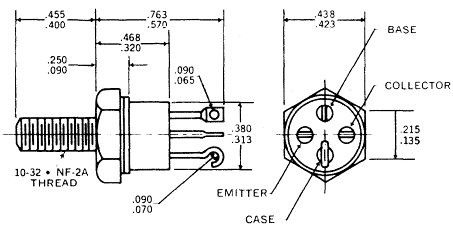
TO-92



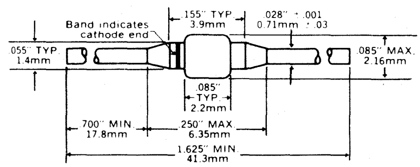
TO-98



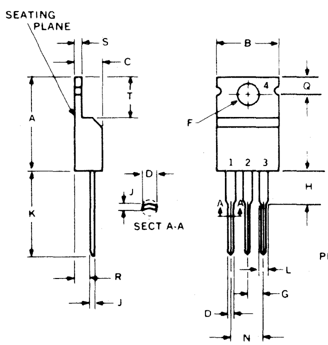
TO-111



A



TO-220AB



PIN 1. BASE
2. COLLECTOR
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	14.23	15.87	0.560	0.625
B	9.66	10.66	0.380	0.420
C	3.56	4.82	0.140	0.190
D	0.51	1.14	0.020	0.045
F	3.531	3.733	0.139	0.147
G	2.29	2.79	0.090	0.110
H		6.35	—	0.250
J	0.38	0.64	0.015	0.025
K	12.70	14.27	0.500	0.562
L	1.14	1.77	0.045	0.070
N	4.83	5.33	0.190	0.210
Q	2.54	3.04	0.100	0.120
R	2.04	2.92	0.080	0.115
S	1.14	1.39	0.045	0.055
T	5.85	6.85	0.230	0.270

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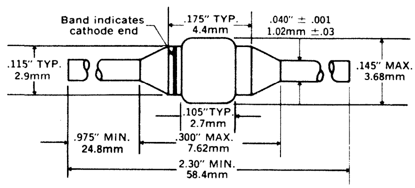
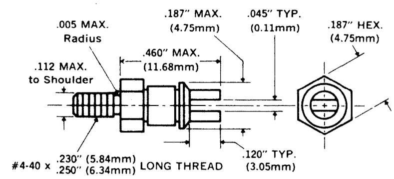
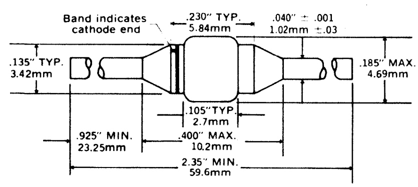
B



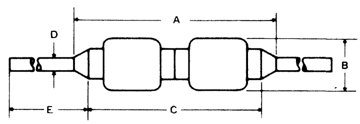
C



CL

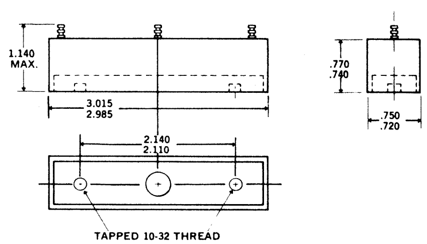


AA, BB, CCL

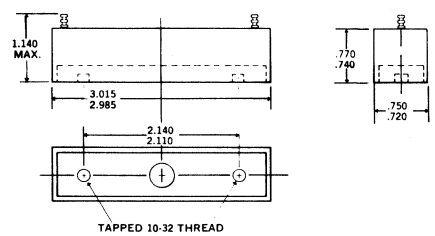


AA	AA	BB	CCL
1 Watt UDZ8807 Series	3 Watt UDZ807 Series	5 Watt UDZ5807 Series	6 Watt UDZ7807 Series
A. .475" max.	A. .450" max.	A. .500" max.	A. .600" max.
B. .104" max.	B. .085" max.	B. .145" max.	B. .185" max.
C. .300" typical	C. .275" typical	C. .325" typical	C. .430" typical
D. .028" ± .001"	D. .028" ± .001"	D. .040" ± .001"	D. .040" ± .001"
E. .975" min.	E. .700" min.	E. .975" min.	E. .925" min.

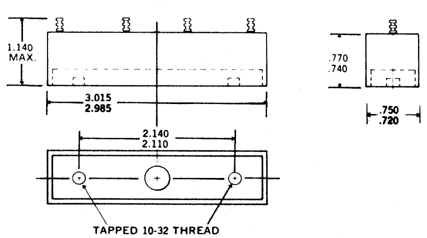
BD



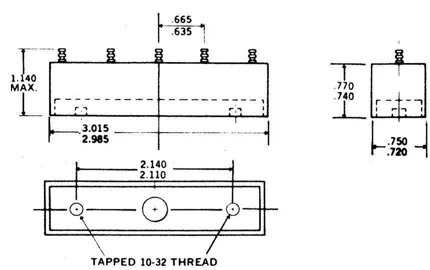
BE



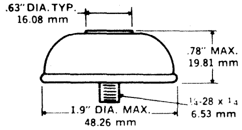
BS



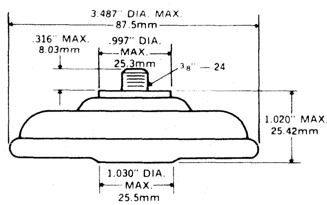
BT



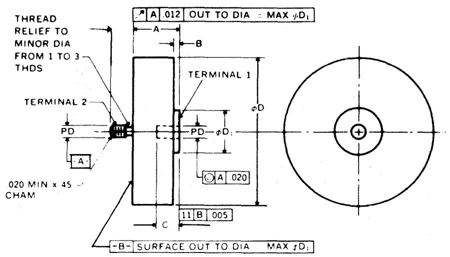
DD



DG



DE, DF



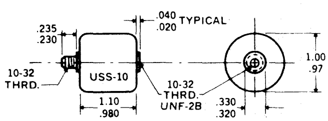
DE

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses		NOTES
	Minimum	Maximum	
A	.73 (18.54)	.83 (21.08)	8
B		.080 (2.03)	
C	.240 (6.10)	.264 (6.71)	2,6
C_1	.265 (6.73)	.400 (10.16)	4
φD	1.85 (46.99)	1.95 (49.53)	
$φD_1$	.57 (14.48)	.67 (17.02)	

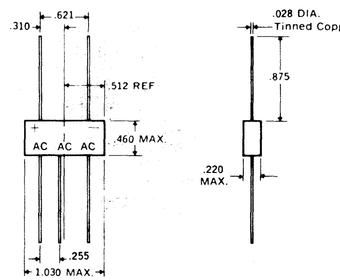
DF

Ltr	Dimensions in inches with metric equivalents (mm) in parentheses		NOTES
	Minimum	Maximum	
A	.970 (24.64)	1.020 (25.91)	8
B	.050 (1.27)	.080 (2.03)	
C	.307 (7.80)	.317 (8.05)	3
C_1	.318 (8.08)	.400 (10.16)	5,7
φD	3.450 (87.63)	3.650 (92.71)	
$φD_1$	.95 (24.13)	1.250 (31.75)	

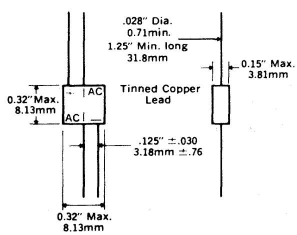
DH



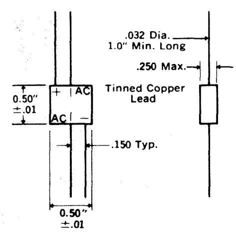
F



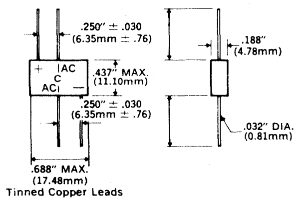
G



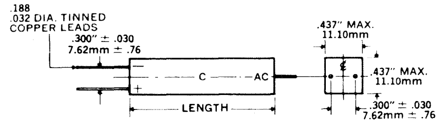
GA



GH



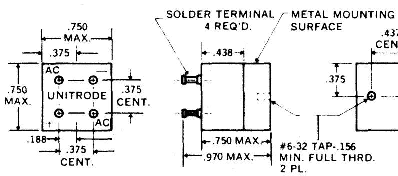
HJ, HK, HL, HM, HN, HO, HP



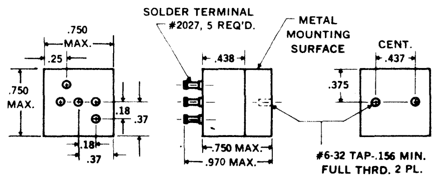
MAX. LENGTHS

J	K	L	M	N	O	P
.562" 14.27mm	.688" 17.48mm	.875" 22.23mm	1.125" 28.58mm	1.25" 31.75mm	1.375" 34.92mm	1.625" 41.28mm

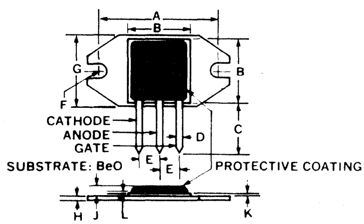
JS



JT

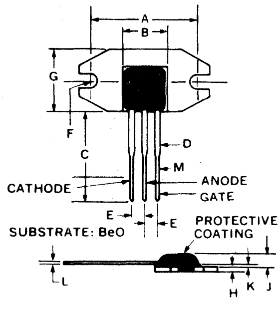


L1



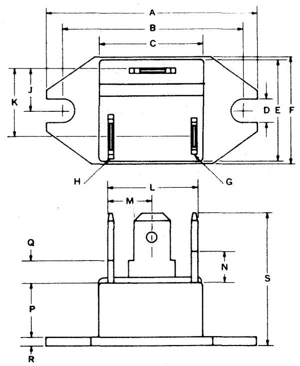
L1 with Flange		
	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.650	16.51
C	.500 NOM.	12.70 NOM.
D	.060	1.53
E	.200	5.08
F	.078 R. TYP.	.20 R. TYP.
G	.690 – .710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51

L2



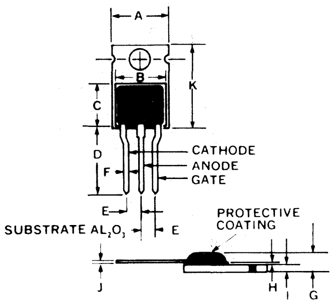
L2 with Flange		
	INS.	mm
A	1.176 – 1.196	29.87 – 30.38
B	.500	12.70
C	1.0 NOM.	25.4 NOM.
D	.060	1.53
E	.150	3.81
F	.078 R. TYP.	.20 R. TYP.
G	.690 – 710	17.52 – 18.04
H	.050	1.27
J	.150	3.81
K	.025	.64
L	.020	.51
M	.040	1.02

L3



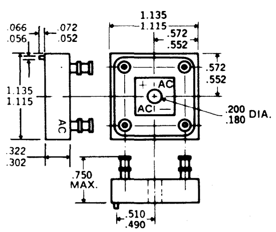
	DIMENSIONS	
	Ins.	mm
A	1.395	35.43
B	1.187	30.15
C	.675	17.15
D	.156 (TYP.)	3.96 (TYP.)
E	.675	17.15
F	.700	
G	.187 (.032 THICK) (GATE)	17.78 (0.81 THICK) (GATE)
H	.250 (.032 THICK) (2 PLACES)	6.35 (0.81 THICK) (GATE)
J	.290	7.37
K	.442	11.23
L	.580	14.73
M	.280	7.11
N	.218	5.54
P	.360	9.14
Q	.156 (2 PLACES)	3.96 (2 PLACES)
R	.050	1.27
S	.875 (TYPICAL)	22.23 (TYPICAL)

L7

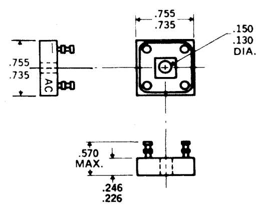


L7 with Flange		
	INS.	mm
A	0.4	10.16
B	.350	8.89
C	.300	7.62
D	.500 MIN.	12.70 MIN.
E	.100	2.54
F	.032	.82
G	.150	3.81
H	.015	.39
I	.020	.51
J	.020	.51

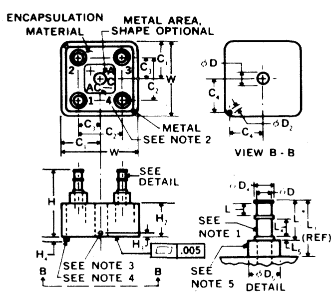
MA



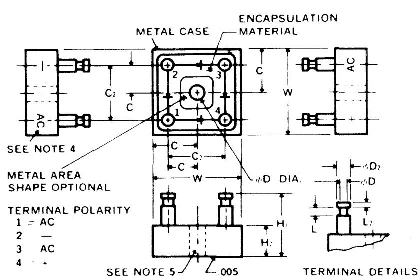
MB



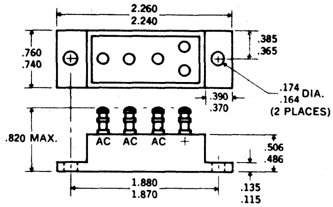
MC



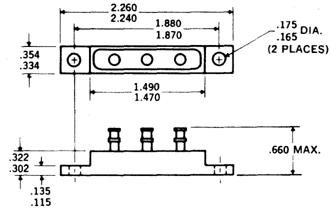
MD



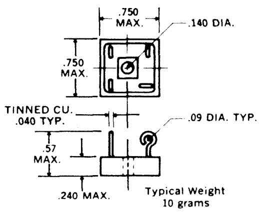
ME



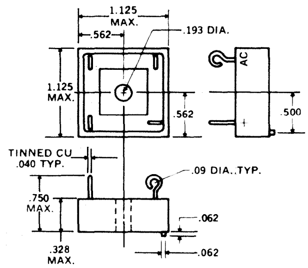
MF



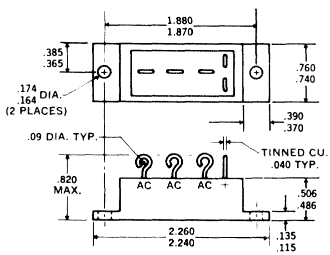
NA



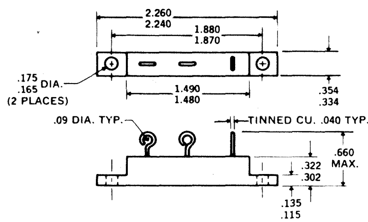
NB



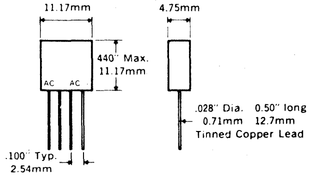
NC



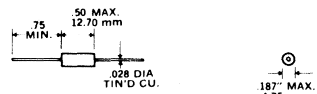
ND



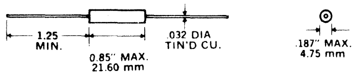
S



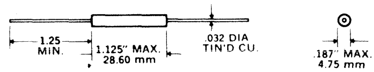
SA



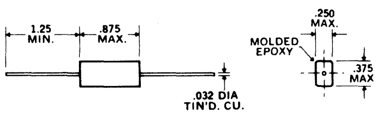
SB


1.25
MIN.
.032 DIA
TIN'D CU.
0.85" MAX.
21.60 mm
.187" MAX.
4.75 mm

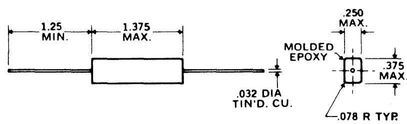
SC


1.25
MIN.
1.125" MAX.
28.60 mm
.032 DIA
TIN'D CU.
.187" MAX.
4.75 mm

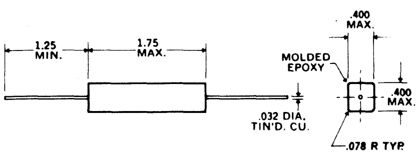
SD


1.25
MIN.
.875
MAX.
.250
MAX.
MOLDED
EPOXY
.375
MAX
.032 DIA
TIN'D. CU.

SE


1.25
MIN.
1.375
MAX.
.250
MAX.
MOLDED
EPOXY
.375
MAX.
.032 DIA
TIN'D. CU.
.078 R TYP.

SF


1.25
MIN.
1.75
MAX.
.400
MAX.
MOLDED
EPOXY
.400
MAX.
.032 DIA.
TIN'D. CU.
.078 R TYP.

NOTES

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