MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

1N3879 thru 1N3883 MR1366

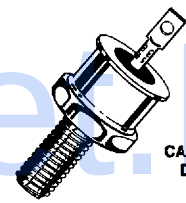
Designers Data Sheet

1N3881 and MR1366 are Motorola Preferred Devices

STUD MOUNTED FAST RECOVERY POWER RECTIFIERS

. . . designed for special applications such as dc power supplies, inverters, converters, ultrasonic systems, choppers, low RF interference, sonar power supplies and free wheeling diodes. A complete line of fast recovery rectifiers having typical recovery time of 150 nanoseconds providing high efficiency at frequencies to 250 kHz.

FAST RECOVERY POWER RECTIFIERS
50-600 VOLTS
6 AMPERES



CASE 245A-02
DO-203AA
METAL

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Designer's Data for "Worst Case" Conditions

The Designers Data sheets permit the design of most circuits entirely from the information presented. Limit curves — representing boundaries on device characteristics — are given to facilitate "worst case" design.

MECHANICAL CHARACTERISTICS

CASE: Welded, hermetically sealed

FINISH: All external surfaces corrosion resistant and readily solderable

POLARITY: Cathode to Case

WEIGHT: 5.6 Grams (approximately)

MOUNTING TORQUE: 15 in-lbs max.

*MAXIMUM RATINGS

Rating	Symbol	1N3879	1N3880	1N3881	1N3882	1N3883	MR1366	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	V_{RRM} V_{RWM} V_R	50	100	200	300	400	600	Volts
Non-Repetitive Peak Reverse Voltage	V_{RSM}	75	150	250	350	450	650	Volts
RMS Reverse Voltage	$V_{R(RMS)}$	35	70	140	210	280	420	Volts
Average Rectified Forward Current (Single phase, resistive load, T_C = 100°C)	I_O	← 6.0 →						Amps
Non-Repetitive Peak Surge Current (surge applied at rated load conditions)	I_{FSM}	← 150 (one cycle) →						Amps
Operating Junction Temperature Range	T_J	← −65 to +150 →						°C
Storage Temperature Range	T_{stg}	← −65 to +175 →						°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.0	°C/W

Motorola guarantees the listed value, although parts having higher values of thermal resistance will meet the current rating. Thermal resistance is not required by the JEDEC registration.

*ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Instantaneous Forward Voltage (i_F = 19 Amp, T_J = 150°C)	v_F	—	1.2	1.5	Volts
Forward Voltage (I_F = 6.0 Amp, T_C = 25°C)	V_F	—	1.0	1.4	Volts
Reverse Current (rated dc voltage) T_C = 25°C T_C = 100°C	I_R	— —	10 0.5	15 1.0	µA mA

REVERSE RECOVERY CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
Reverse Recovery Time *(I_{FM} = 1.0 Amp to V_R = 30 Vdc, Figure 16) (I_{FM} = 36 Amp, di/dt = 25 A/µs, Figure 17)	t_{rr}	— —	150 200	200 400	ns
Reverse Recovery Current *(I_F = 1.0 Amp to V_R = 30 Vdc, Figure 16)	$I_{RM(REC)}$	—	—	2.0	Amp

*Indicates JEDEC Registered Data for 1N3879 Series.

1N3879 thru 1N3883, MR1366

FIGURE 1 – FORWARD VOLTAGE

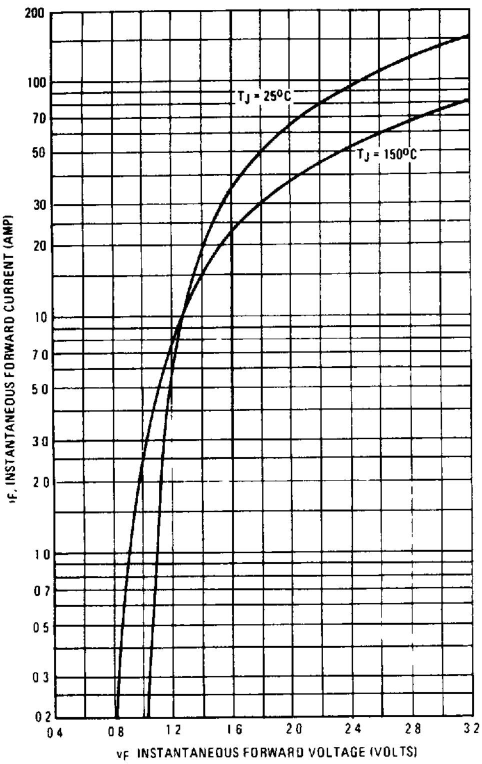
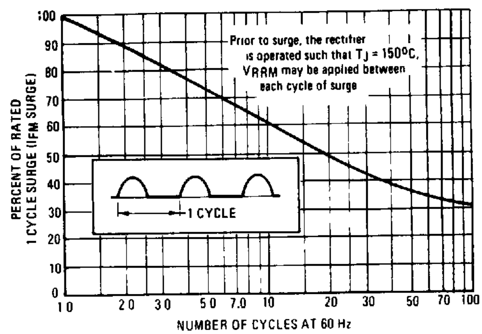
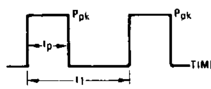


FIGURE 2 – MAXIMUM SURGE CAPABILITY



NOTE 1



DUTY CYCLE $D = t_p/t_1$
PEAK POWER P_{pk} is peak of an equivalent square power pulse

To determine maximum junction temperature of the diode in a given situation the following procedure is recommended

The temperature of the case should be measured using a thermocouple placed on the case at the temperature reference point (see Note 3) The thermal mass connected to the case is normally large enough so that it will not significantly respond to heat surges generated in the diode as a result of pulsed operation once steady state conditions are achieved Using the measured value of T_C the junction temperature may be determined by

$$T_J = T_C + \Delta T_{JC}$$

where ΔT_{JC} is the increase in junction temperature above the case temperature It may be determined by

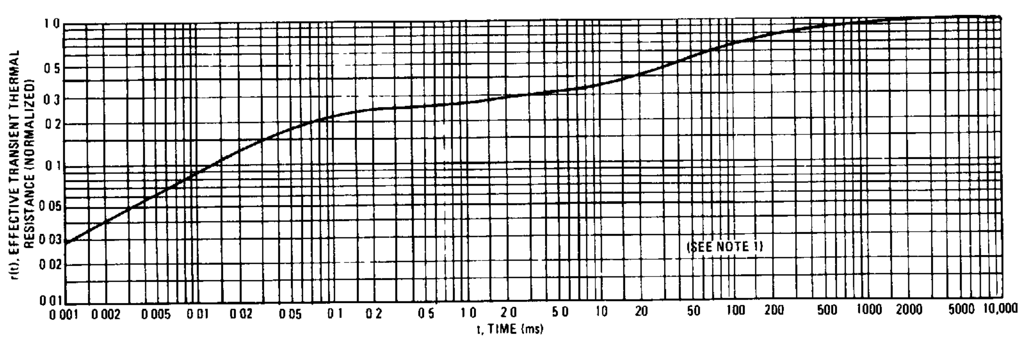
$$\Delta T_{JC} = P_{pk} \cdot R_{\theta JC} [D + (1 - D) \cdot r(t_1 + t_p) + r(t_p) - r(t_1)]$$

where

$r(t)$ = normalized value of transient thermal resistance at time t from Figure 3 i e

$r(t_1 + t_p)$ = normalized value of transient thermal resistance at time $t_1 + t_p$

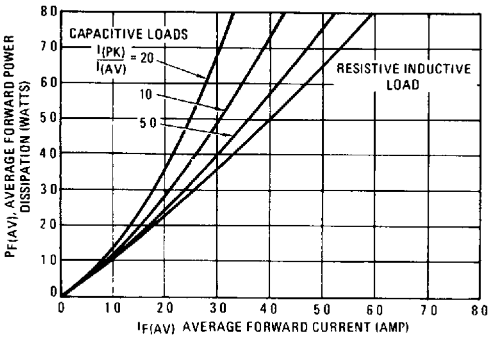
FIGURE 3 – THERMAL RESPONSE



1N3879 thru 1N3883, MR1366

SINE WAVE INPUT

FIGURE 4 – FORWARD POWER DISSIPATION



SQUARE WAVE INPUT

FIGURE 5 – FORWARD POWER DISSIPATION

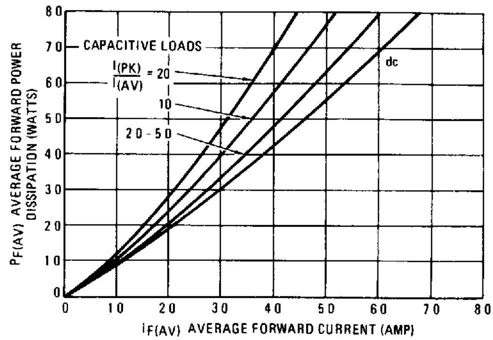


FIGURE 6 – CURRENT DERATING

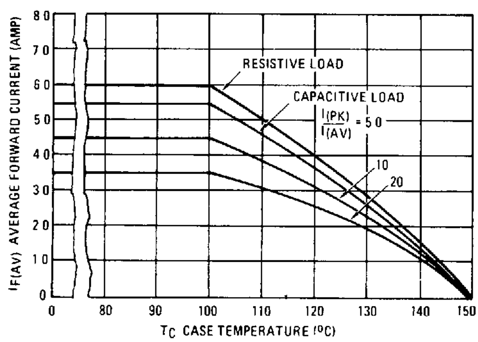


FIGURE 7 – CURRENT DERATING

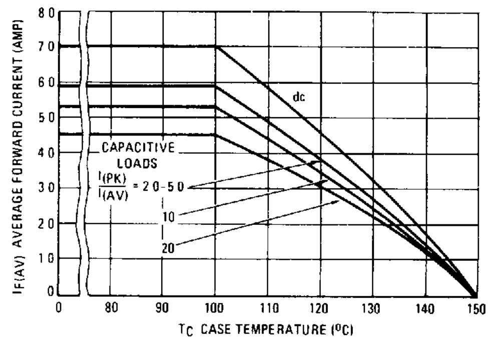


FIGURE 8 – TYPICAL REVERSE CURRENT

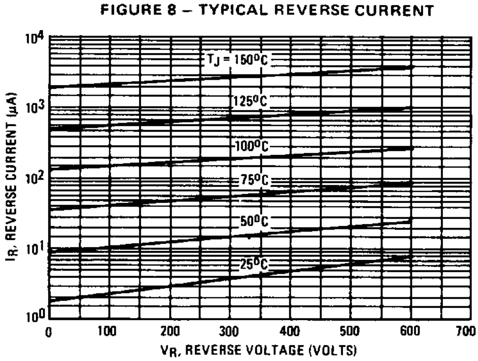
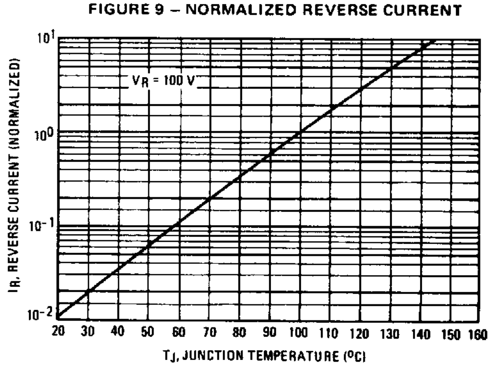


FIGURE 9 – NORMALIZED REVERSE CURRENT



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1N3879 thru 1N3883, MR1366

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TYPICAL DYNAMIC CHARACTERISTICS

FIGURE 10 – FORWARD RECOVERY TIME

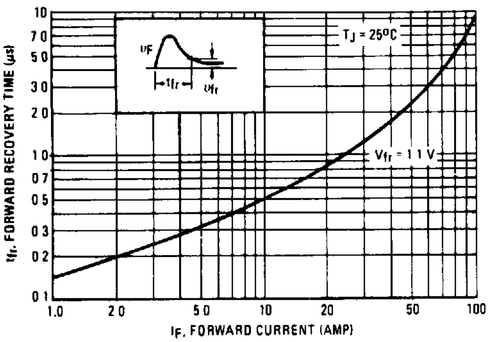
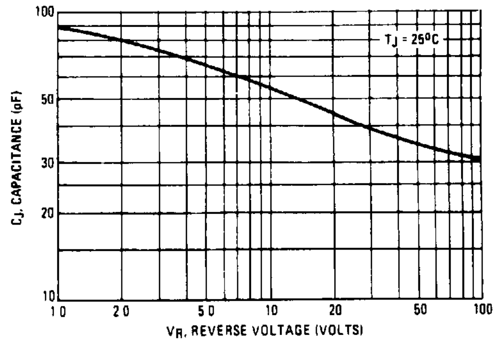


FIGURE 11 – JUNCTION CAPACITANCE



TYPICAL RECOVERED STORED CHARGE DATA

(See Note 2)

FIGURE 12 – T_J = 25°C

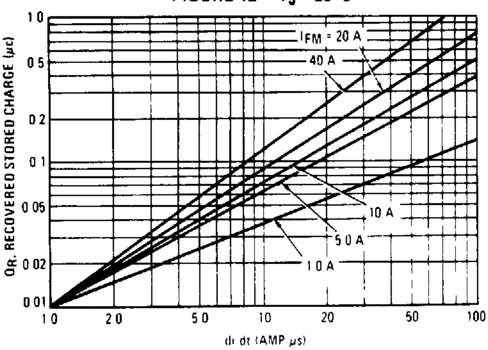


FIGURE 13 – T_J = 75°C

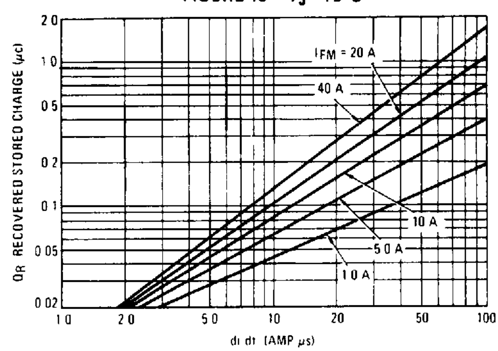


FIGURE 14 – T_J = 100°C

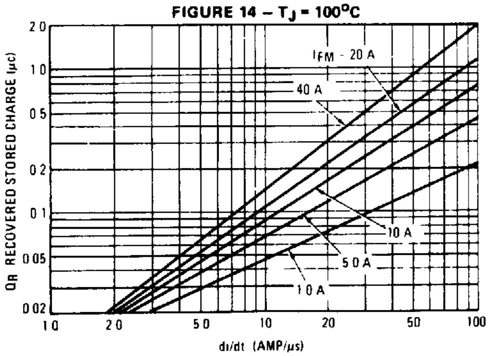


FIGURE 15 – T_J = 150°C

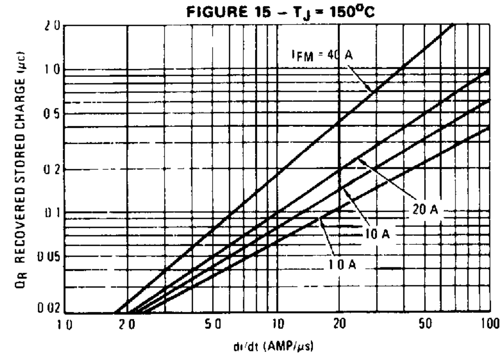
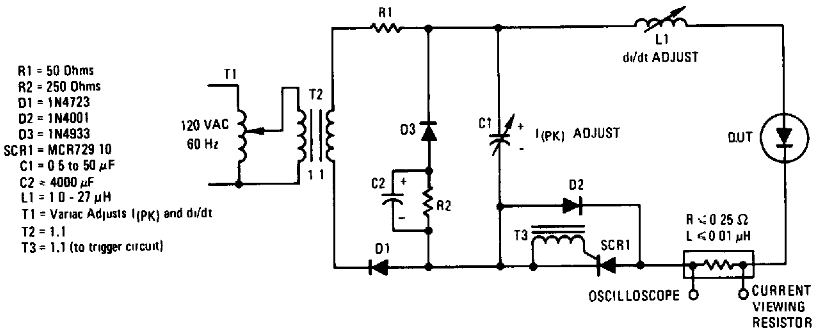


FIGURE 16 — JEDEC REVERSE RECOVERY CIRCUIT



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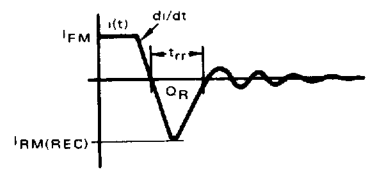
NOTE 2

Reverse recovery time is the period which elapses from the time that the current, thru a previously forward biased rectifier diode, passes thru zero going negatively until the reverse current recovers to a point which is less than 10% peak reverse current

Reverse recovery time is a direct function of the forward current prior to the application of reverse voltage

For any given rectifier, recovery time is very circuit dependent Typical and maximum recovery time of all Motorola fast recovery power rectifiers are rated under a fixed set of conditions using I_F = 1 0 A, V_R = 30 V In order to cover all circuit conditions, curves are given for typical recovered stored charge versus commutation di/dt for various levels of forward current and for junction temperatures of 25°C, 75°C, 100°C, and 150°C

To use these curves, it is necessary to know the forward current level just before commutation, the circuit commutation di/dt, and the operating junction temperature The reverse recovery test current waveform for all Motorola fast recovery rectifiers is shown



From stored charge curves versus di/dt, recovery time (t_{rr}) and peak reverse recovery current ($I_{RM(REC)}$) can be closely approximated using the following formulas

$$t_{rr} = 1\ 41 \times \left[\frac{Q_R}{di/dt}\right]^{1/2}$$

$$I_{RM(REC)} = 1\ 41 \times \left[Q_R \times di/dt\right]^{1/2}$$