

# MSR860G, MSRF860G

## Switch-mode Soft Recovery Power Rectifiers Plastic TO-220 Package

These state-of-the-art devices are designed for use as free wheeling diodes in variable speed motor control applications and switching power supplies.

### Features

- Soft Recovery with Guaranteed Low Reverse Recovery Charge ( $Q_{RR}$ ) and Peak Reverse Recovery Current ( $I_{RRM}$ )
- 150°C Operating Junction Temperature
- Epoxy meets UL 94 V-0 @ 0.125 in
- Low Forward Voltage
- Low Leakage Current
- These are Pb-Free Devices

### Mechanical Characteristics:

- Case: Epoxy, Molded
- Weight: 1.9 Grams (Approximately)
- Finish: All External Surfaces Corrosion Resistant and Terminal Leads Readily Solderable
- Lead Temperature for Soldering Purposes: 260°C Max. for 10 Seconds

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Peak Repetitive Reverse Voltage Working Peak Reverse Voltage DC Blocking Voltage	$V_{RRM}$ $V_{RWM}$ $V_R$	600	V
Average Rectified Forward Current (Rated $V_R$ , $T_C = 125^\circ\text{C}$ )	$I_O$	8.0	A
Peak Repetitive Forward Current (Rated $V_R$ , Square Wave, 20 kHz, $T_C = 125^\circ\text{C}$ )	$I_{FRM}$	16	A
Non-Repetitive Peak Surge Current (Surge Applied at Rated Load Conditions Halfwave, Single Phase, 60 Hz)	$I_{FSM}$	100	A
Storage/Operating Case Temperature	$T_{stg}$ , $T_C$	-65 to +150	°C
Operating Junction Temperature	$T_J$	-65 to +150	°C

### THERMAL CHARACTERISTICS

Parameter	Symbol	Value	Unit
MSR860G Thermal Resistance, Junction-to-Case Thermal Resistance, Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.6 72.8	°C/W
MSRF860G Thermal Resistance, Junction-to-Case Thermal Resistance, Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	4.75 75	°C/W

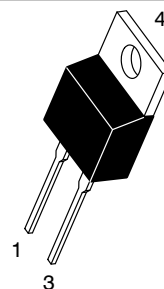
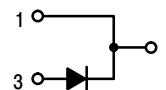
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.



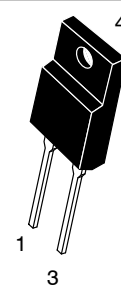
ON Semiconductor®

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## SOFT RECOVERY POWER RECTIFIER 8.0 AMPERES, 600 VOLTS



TO-220AC  
CASE 221B  
STYLE 1



TO-220 FULLPAK  
CASE 221AG  
STYLE 1

### MARKING DIAGRAMS



- A = Assembly Location
- Y = Year
- WW = Work Week
- G = Pb-Free Package
- KA = Diode Polarity

### ORDERING INFORMATION

Device	Package	Shipping
MSR860G	TO-220AC (Pb-Free)	50 Units / Rail
MSRF860G	TO-220FP (Pb-Free)	50 Units / Rail

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## ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
Maximum Instantaneous Forward Voltage ( $I_F = 8.0\text{ A}$ ) (Note 1) Maximum Typical	$V_F$	$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	V
		1.7 1.4	1.3 1.1	
Maximum Instantaneous Reverse Current ( $V_R = 600\text{ V}$ ) Maximum Typical	$I_R$	$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	$\mu\text{A}$
		10 2.0	1000 80	
Maximum Reverse Recovery Time (Note 2) ( $V_R = 400\text{ V}$ , $I_F = 8.0\text{ A}$ , $di/dt = 200\text{ A}/\mu\text{s}$ ) Maximum Typical	$t_{rr}$	$T_J = 25^\circ\text{C}$	$T_J = 125^\circ\text{C}$	ns
		120 95	190 125	
Typical Recovery Softness Factor ( $V_R = 400\text{ V}$ , $I_F = 8.0\text{ A}$ , $di/dt = 200\text{ A}/\mu\text{s}$ )	$s = t_b/t_a$	2.5	3.0	
Maximum Peak Reverse Recovery Current ( $V_R = 400\text{ V}$ , $I_F = 8.0\text{ A}$ , $di/dt = 200\text{ A}/\mu\text{s}$ )	$I_{RRM}$	5.8	8.3	A
Maximum Reverse Recovery Charge ( $V_R = 400\text{ V}$ , $I_F = 8.0\text{ A}$ , $di/dt = 200\text{ A}/\mu\text{s}$ )	$Q_{RR}$	350	700	nC

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

1. Pulse Test: Pulse Width  $\leq 380\ \mu\text{s}$ , Duty Cycle  $\leq 2\%$
2.  $T_{RR}$  measured projecting from 25% of  $I_{RRM}$  to zero current

## TYPICAL ELECTRICAL CHARACTERISTICS

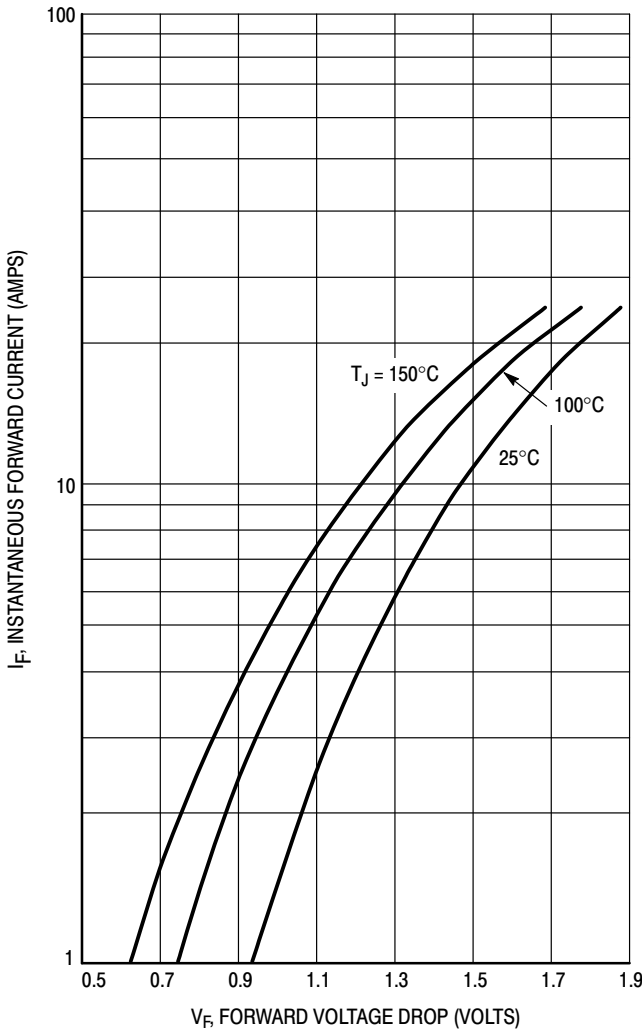


Figure 1. Typical Forward Voltage

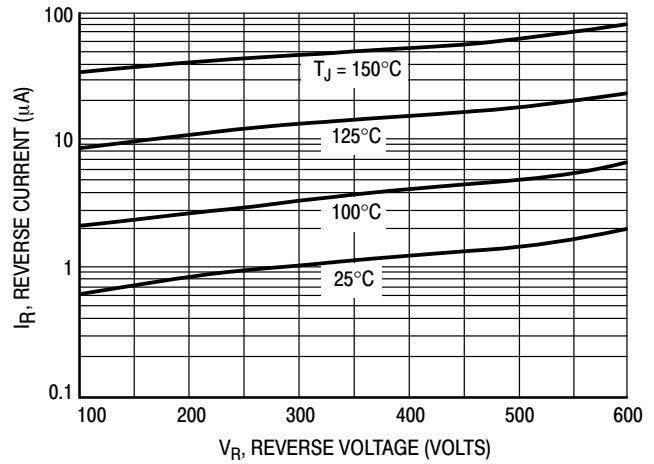


Figure 2. Typical Reverse Current

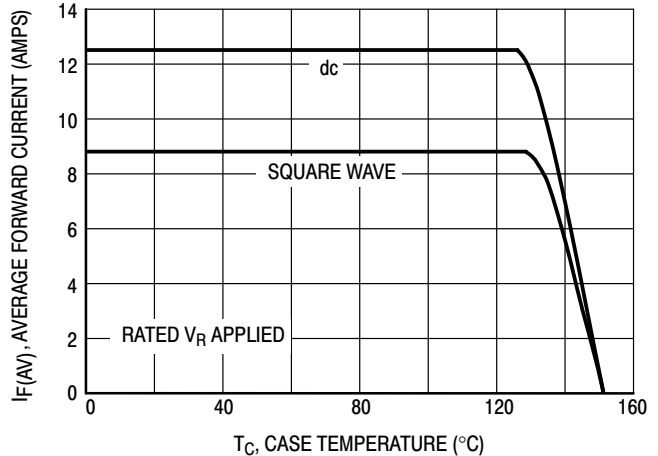


Figure 3. Current Derating, Case

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## TYPICAL ELECTRICAL CHARACTERISTICS

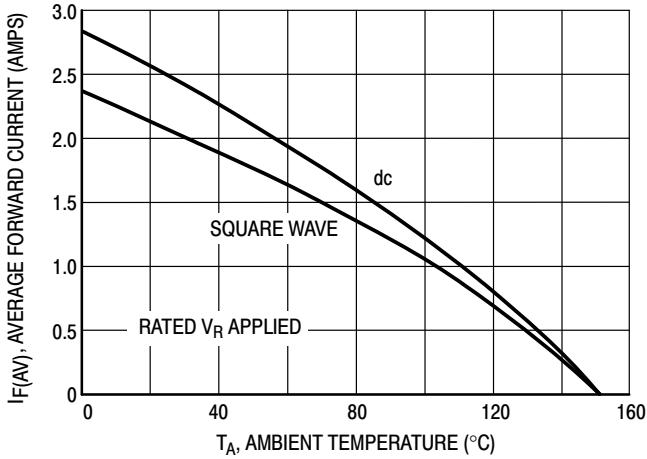


Figure 4. Current Derating, Ambient

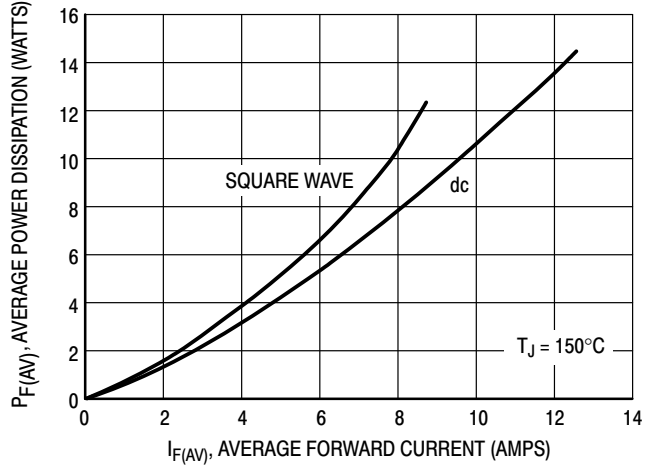


Figure 5. Power Dissipation

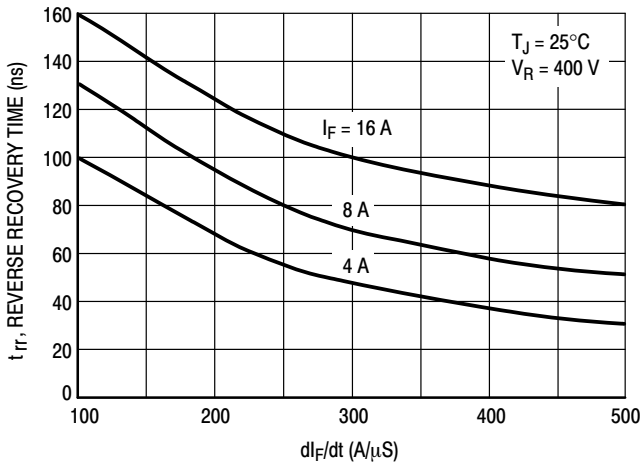


Figure 6. Typical Reverse Recovery Time

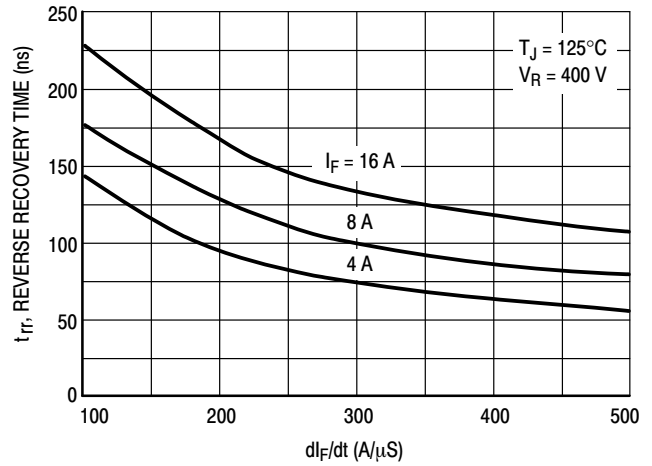


Figure 7. Typical Reverse Recovery Time

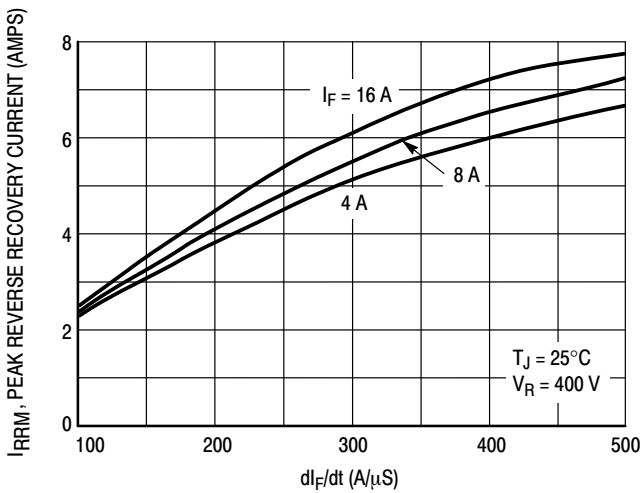


Figure 8. Typical Peak Reverse Recovery Current

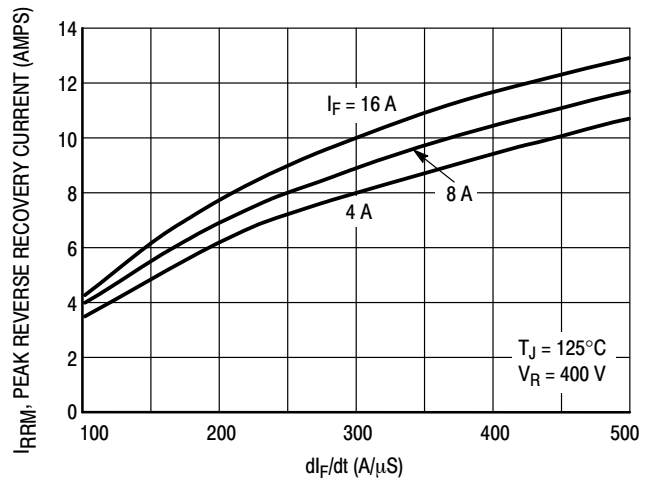


Figure 9. Typical Peak Reverse Recovery Current

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## TYPICAL ELECTRICAL CHARACTERISTICS

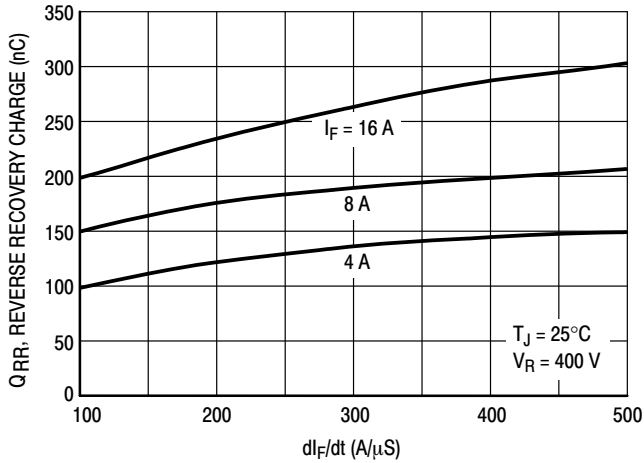


Figure 10. Typical Reverse Recovery Charge

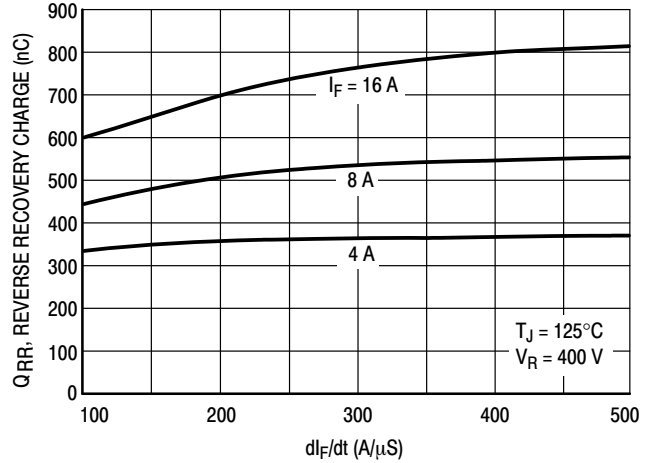


Figure 11. Typical Reverse Recovery Charge

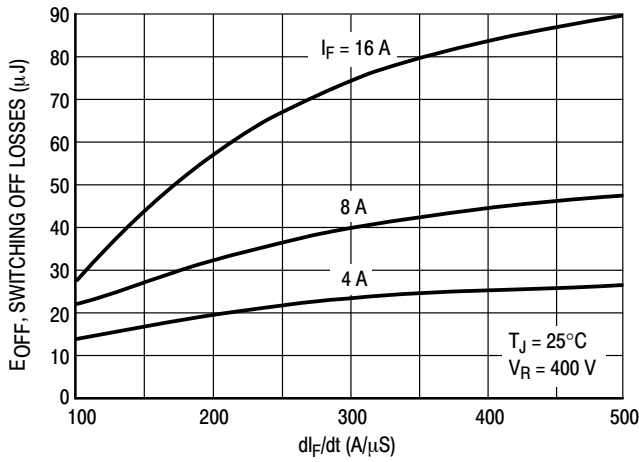


Figure 12. Typical Switching Off Losses

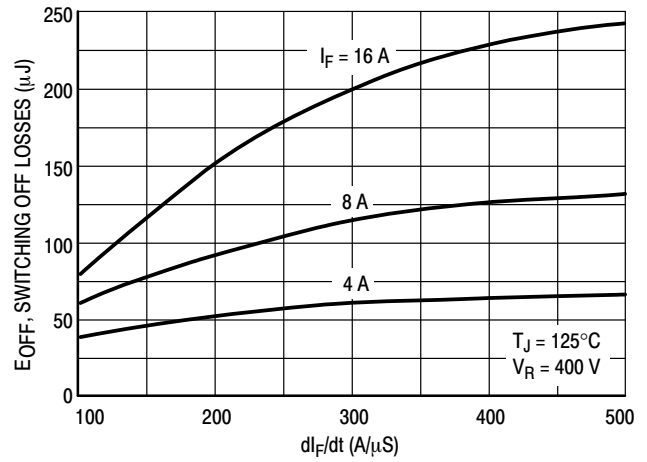


Figure 13. Typical Switching Off Losses

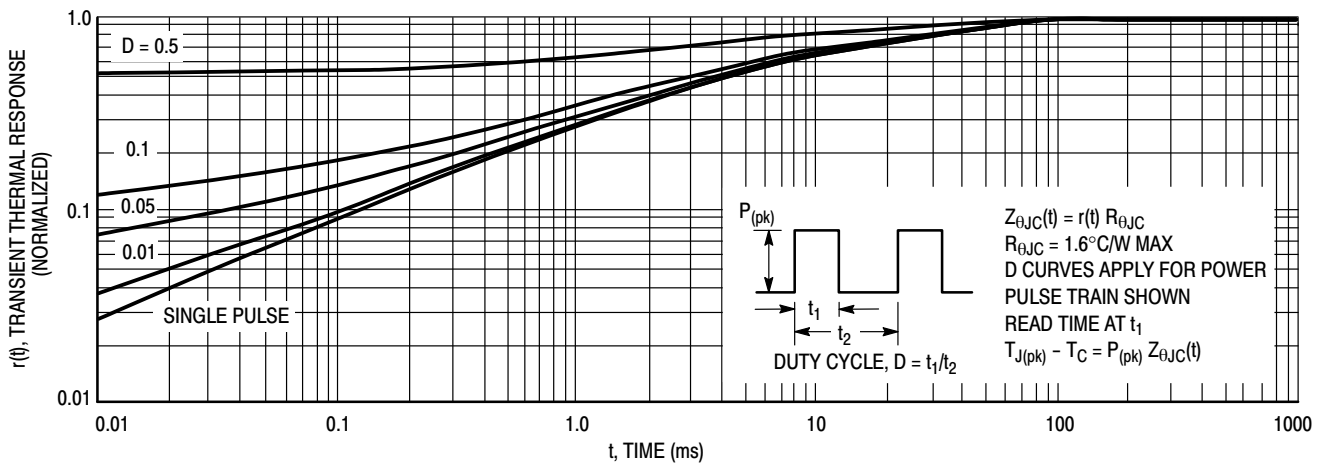


Figure 14. Thermal Response (MSR860)

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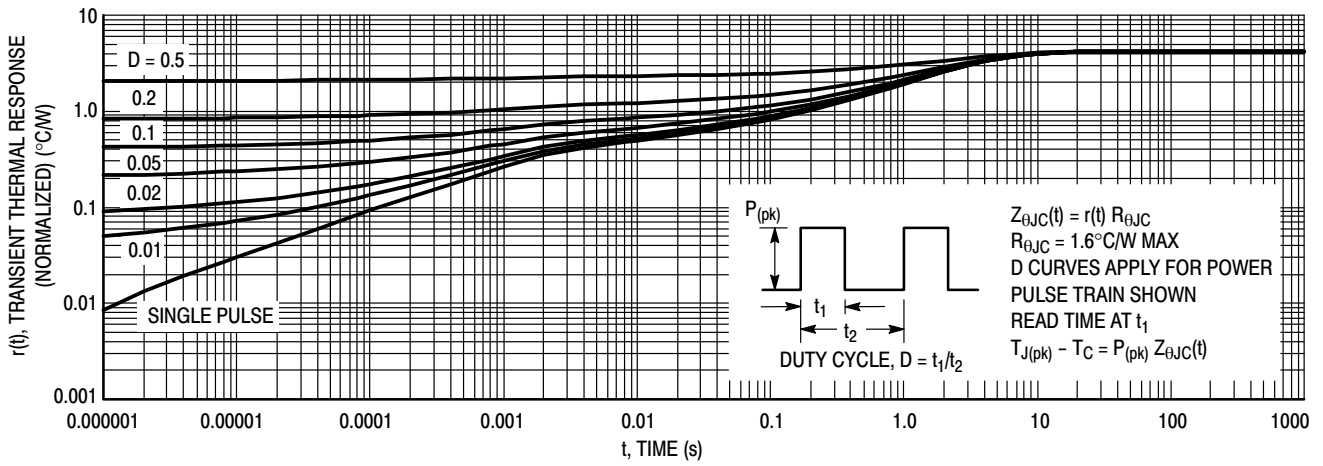


Figure 15. Thermal Response, (MSRF860) Junction-to-Case ( $R_{\theta JC}$ )

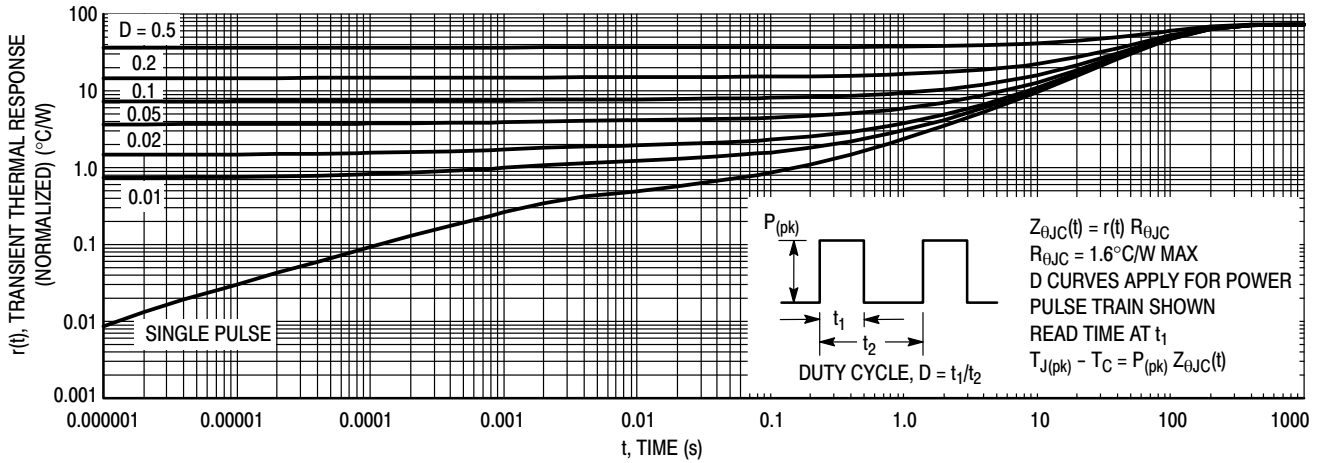
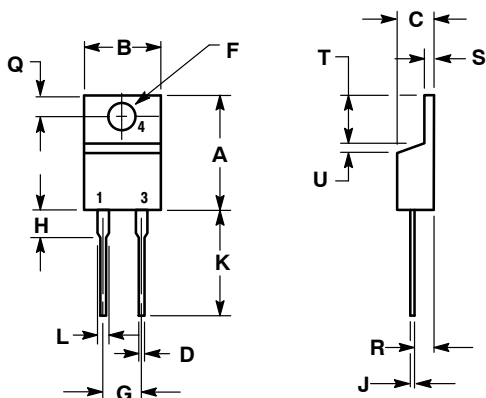


Figure 16. Thermal Response, (MSRF860) Junction-to-Ambient ( $R_{\theta JA}$ )

# MSR860G, MSRF860G

## PACKAGE DIMENSIONS

### TO-220 TWO-LEAD CASE 221B-04 ISSUE F

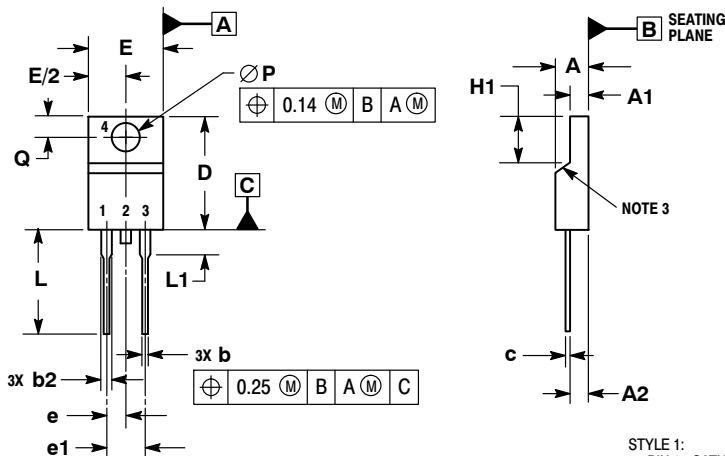


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.595	0.620	15.11	15.75
B	0.380	0.405	9.65	10.29
C	0.160	0.190	4.06	4.82
D	0.025	0.039	0.64	1.00
F	0.142	0.161	3.61	4.09
G	0.190	0.210	4.83	5.33
H	0.110	0.130	2.79	3.30
J	0.014	0.025	0.36	0.64
K	0.500	0.562	12.70	14.27
L	0.045	0.060	1.14	1.52
Q	0.100	0.120	2.54	3.04
R	0.080	0.110	2.04	2.79
S	0.045	0.055	1.14	1.39
T	0.235	0.255	5.97	6.48
U	0.000	0.050	0.000	1.27

- STYLE 1:  
PIN 1. CATHODE  
2. N/A  
3. ANODE  
4. CATHODE

### TO-220 FULLPAK, 2-LEAD CASE 221AG ISSUE A



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.  
2. CONTROLLING DIMENSION: MILLIMETERS.  
3. CONTOUR UNCONTROLLED IN THIS AREA.  
4. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH AND GATE PROTRUSIONS. MOLD FLASH AND GATE PROTRUSIONS NOT TO EXCEED 0.13 PER SIDE. THESE DIMENSIONS ARE TO BE MEASURED AT OUTERMOST EXTREME OF THE PLASTIC BODY.  
5. DIMENSION b2 DOES NOT INCLUDE DAMBAR PROTRUSION. LEAD WIDTH INCLUDING PROTRUSION SHALL NOT EXCEED 2.00.

DIM	MILLIMETERS	
	MIN	MAX
A	4.30	4.70
A1	2.50	2.90
A2	2.50	2.90
b	0.54	0.84
b2	1.10	1.40
c	0.49	0.79
D	14.22	15.88
E	9.65	10.67
e	2.54 BSC	
e1	5.08 BSC	
H1	5.97	6.48
L	12.70	14.73
L1	---	2.80
P	3.00	3.40
Q	2.80	3.20

- STYLE 1:  
PIN 1. CATHODE  
2. N/A  
3. ANODE

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