

# MSR860, MSRF860

## SWITCHMODE™ 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
- Pb-Free Package is Available

### 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
MSR860 Thermal Resistance, Junction-to-Case Thermal Resistance, Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	1.6 72.8	°C/W
MSRF860 Thermal Resistance, Junction-to-Case Thermal Resistance, Junction-to-Ambient	$R_{\theta JC}$ $R_{\theta JA}$	4.75 75	°C/W

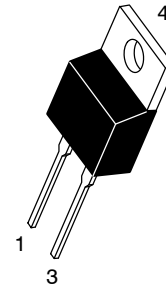
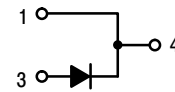
Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.



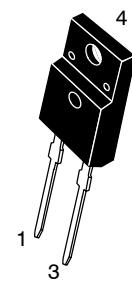
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## SOFT RECOVERY POWER RECTIFIER 8.0 AMPERES, 600 VOLTS

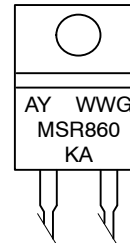


TO-220AC  
CASE 221B  
STYLE 1



TO-220 FULLPAK  
CASE 221E  
STYLE 1

### MARKING DIAGRAMS



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

### ORDERING INFORMATION

Device	Package	Shipping
MSR860	TO-220AC	50 Units/Rail
MSR860G	TO-220AC (Pb-Free)	50 Units/Rail
MSRF860G	TO-220FP (Pb-Free)	50 Units/Rail

# MSR860, MSRF860

## ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Value		Unit
		$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	
Maximum Instantaneous Forward Voltage ( $I_F = 8.0\text{ A}$ ) (Note 1) Maximum Typical	$V_F$	1.7 1.4	1.3 1.1	V
		$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	
Maximum Instantaneous Reverse Current ( $V_R = 600\text{ V}$ ) Maximum Typical	$I_R$	10 2.0	1000 80	$\mu\text{A}$
		$T_J = 25^\circ\text{C}$	$T_J = 150^\circ\text{C}$	
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	$t_{rr}$	120 95	190 125	ns
		$T_J = 25^\circ\text{C}$	$T_J = 125^\circ\text{C}$	
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

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

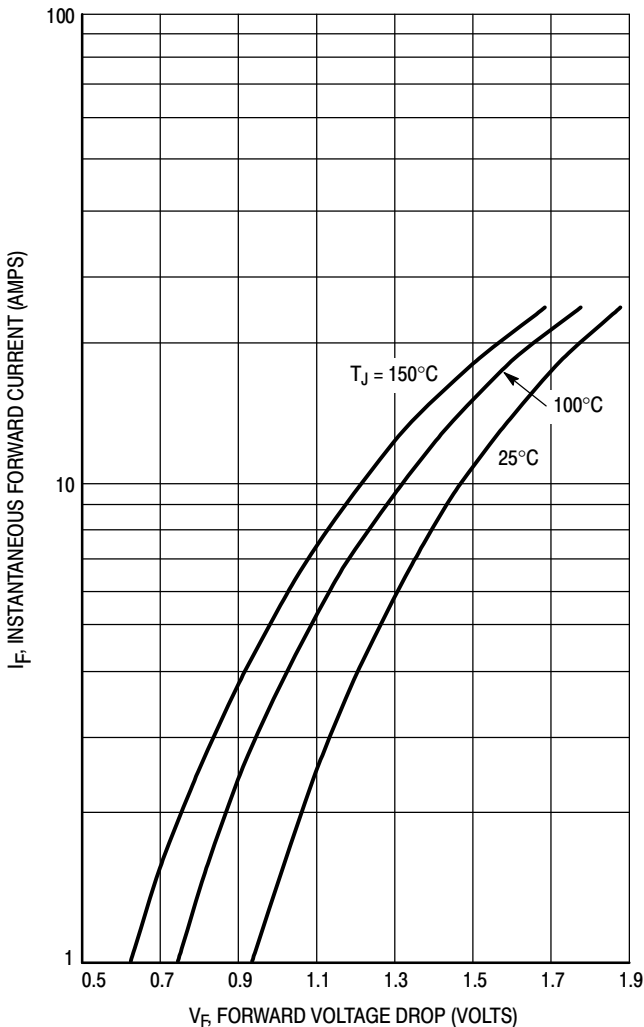


Figure 1. Typical Forward Voltage

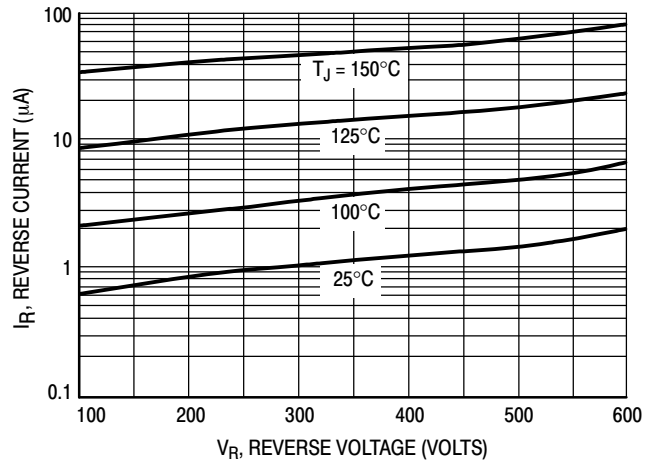


Figure 2. Typical Reverse Current

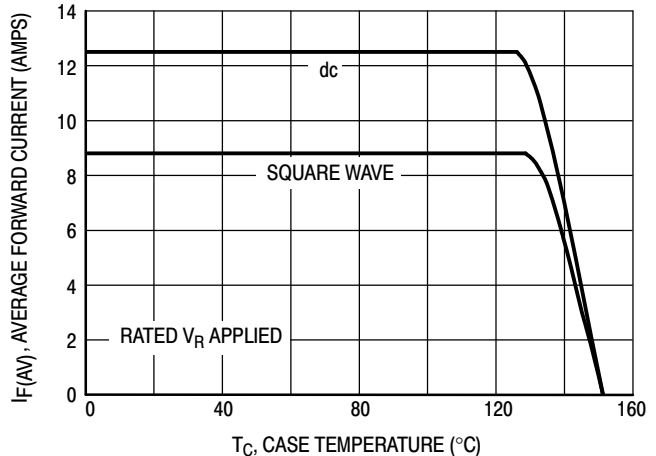


Figure 3. Current Derating, Case

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## TYPICAL ELECTRICAL CHARACTERISTICS

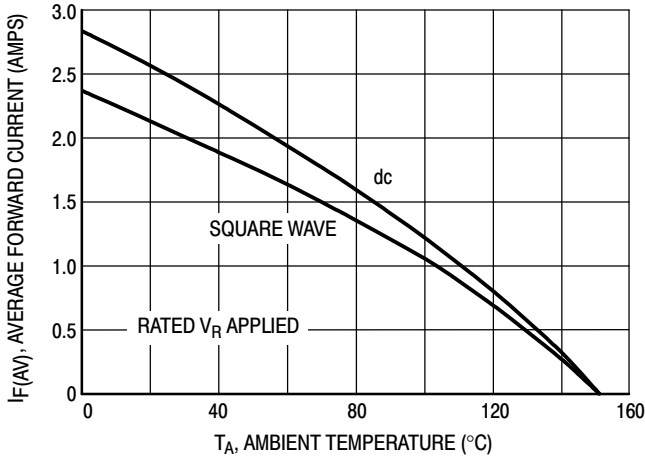


Figure 4. Current Derating, Ambient

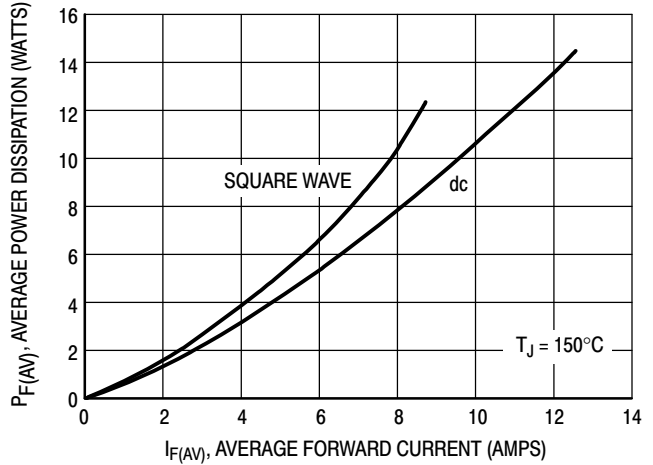


Figure 5. Power Dissipation

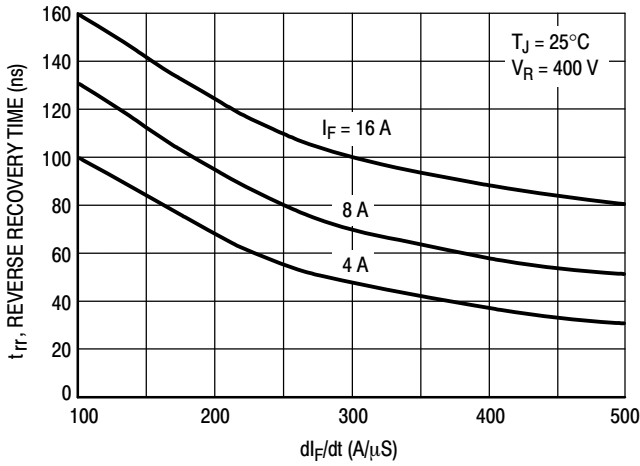


Figure 6. Typical Reverse Recovery Time

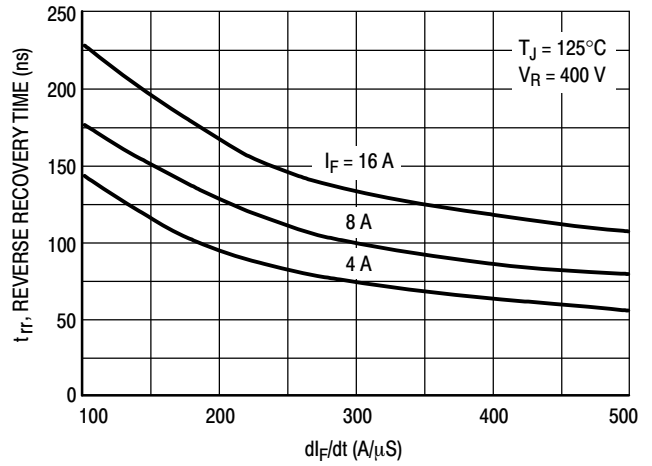


Figure 7. Typical Reverse Recovery Time

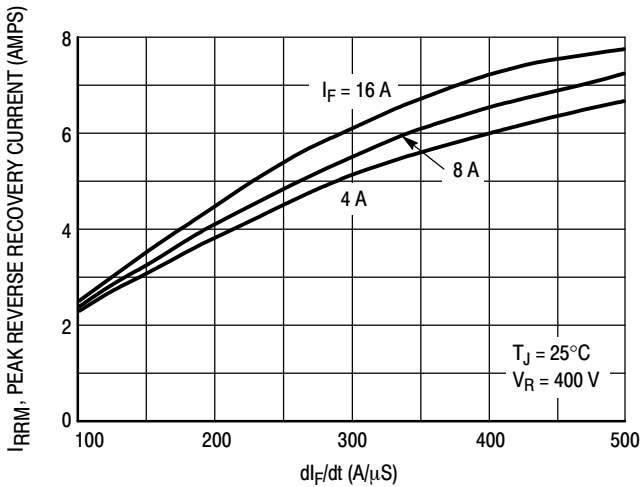


Figure 8. Typical Peak Reverse Recovery Current

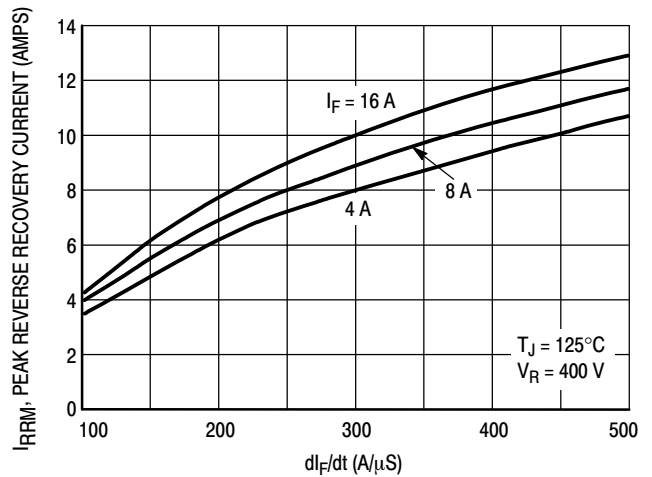


Figure 9. Typical Peak Reverse Recovery Current

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## TYPICAL ELECTRICAL CHARACTERISTICS

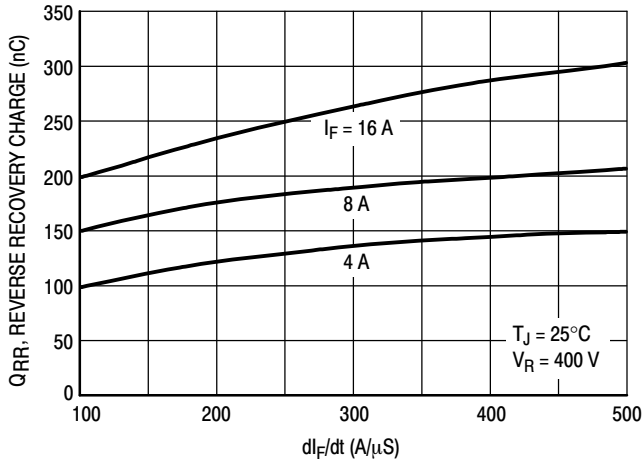


Figure 10. Typical Reverse Recovery Charge

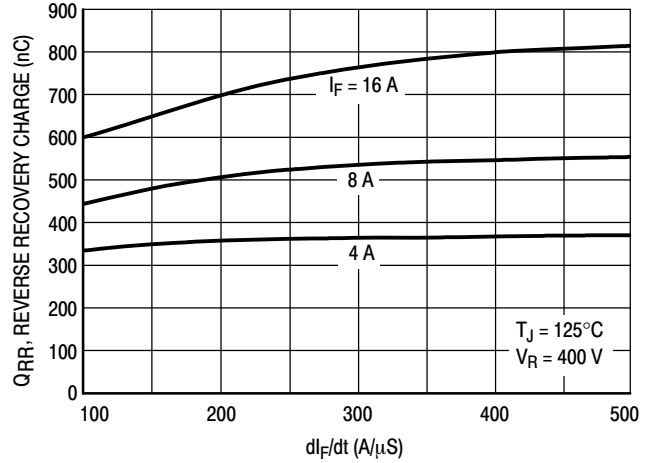


Figure 11. Typical Reverse Recovery Charge

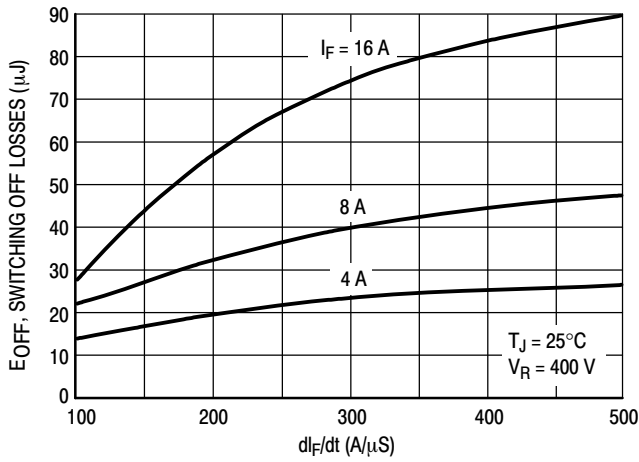


Figure 12. Typical Switching Off Losses

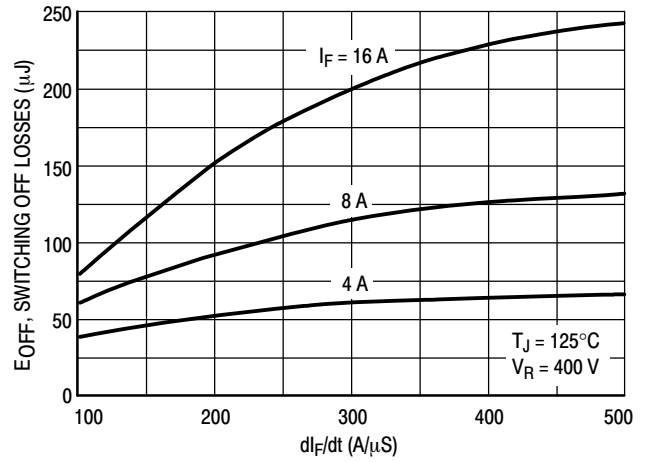


Figure 13. Typical Switching Off Losses

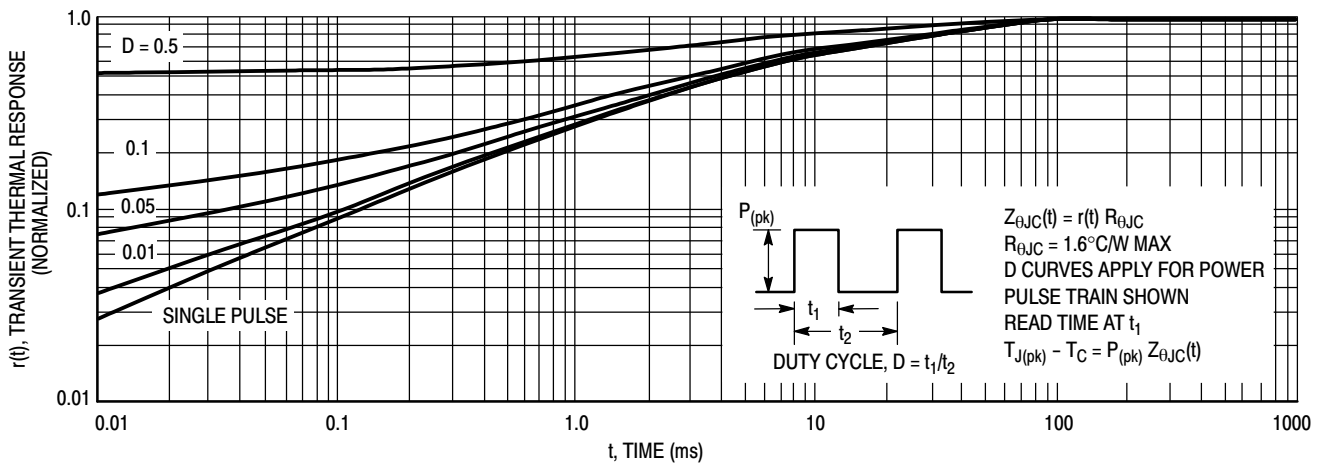


Figure 14. Thermal Response (MSR860)

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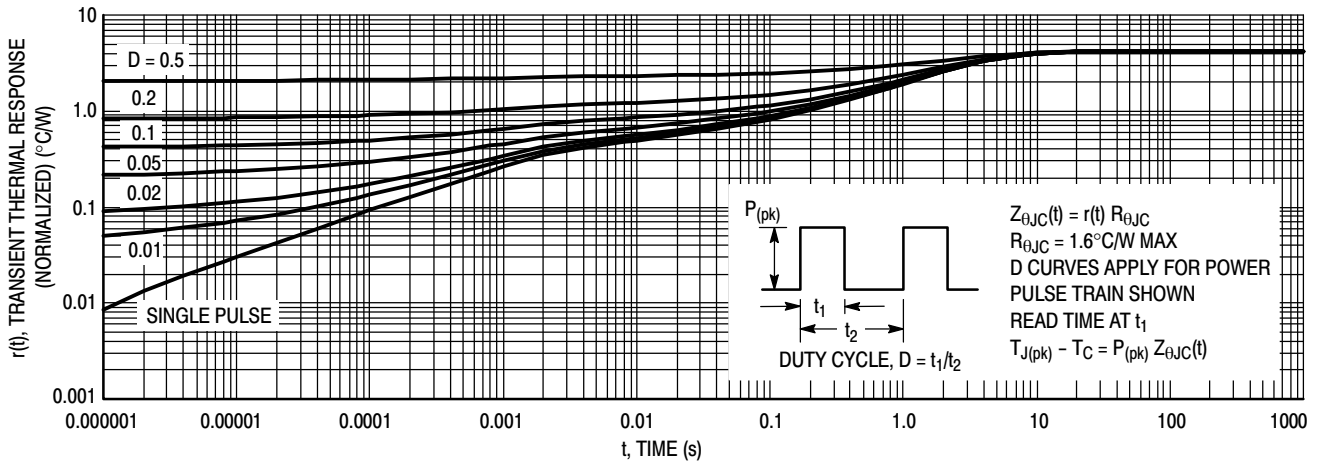


Figure 15. Thermal Response, (MSRF860) Junction-to-Case ( $R_{\theta JC}$ )

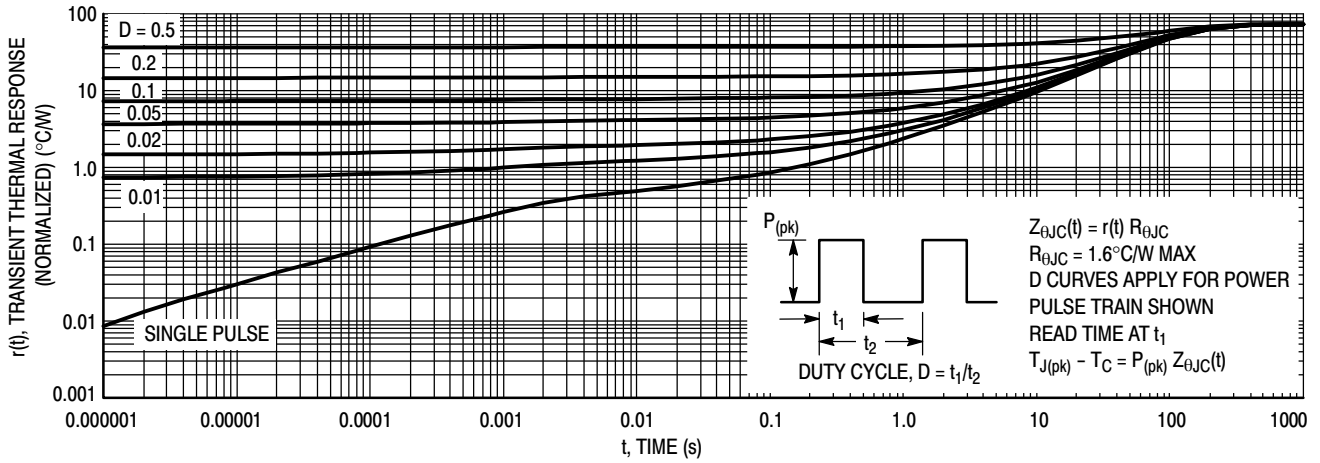
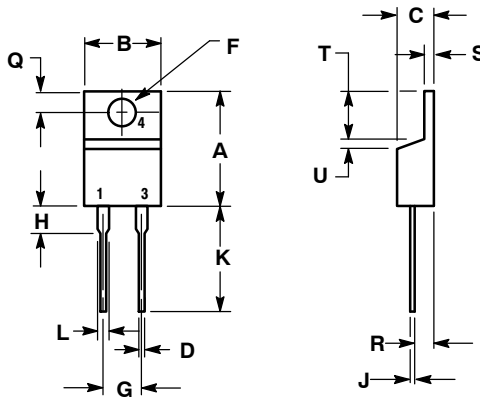


Figure 16. Thermal Response, (MSRF860) Junction-to-Ambient ( $R_{\theta JA}$ )

# MSR860, MSRF860

## PACKAGE DIMENSIONS

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

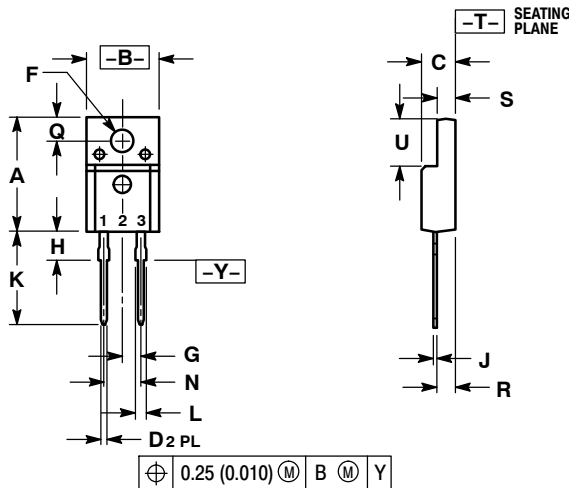


- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.

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	0.035	0.64	0.89
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 221E-01 ISSUE A



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.617	0.633	15.67	16.07
B	0.392	0.408	9.96	10.36
C	0.177	0.193	4.50	4.90
D	0.024	0.039	0.60	1.00
F	0.121	0.129	3.08	3.28
G	0.100 BSC		2.54 BSC	
H	0.117	0.133	2.98	3.38
J	0.018	0.025	0.45	0.64
K	0.499	0.562	12.68	14.27
L	0.045	0.060	1.14	1.52
N	0.200 BSC		5.08 BSC	
Q	0.122	0.138	3.10	3.50
R	0.101	0.117	2.56	2.96
S	0.092	0.108	2.34	2.74
U	0.255	0.271	6.48	6.88

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

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