

**RM28N60ES8** 

## **N-Channel Power MOSFET**

## Description

- VDS 60V , ID 12.6A
  RDS(ON) <11.3mΩ @ VGS = 10V</li>
  RDS(ON) <19mΩ @ VGS = 4.5V</li>
- Trench Power MOSFET Technology
- Low RDSON
- High Efficiency Power Supply

#### **Applications**

- RoHS and Halogen-Free Complaint
- Secondary Synchronous Rectifier
- 100% UIS Tested
- 100% Rg Tested







SOP-8 top view

## Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
RM28N60ES8	28N60	SOP-8	-	-	-

### Absolute Maximum Ratings (T<sub>A</sub>=25℃unless otherwise noted)

Parameters		Symbol	Max	Units
Drain-Source Voltage		V <sub>DS</sub>	60	V
Gate-Source Voltage	V <sub>GS</sub>	±20	V	
Continuous Drain Current	T <sub>A</sub> = +25°C T <sub>A</sub> = +70°C	۱ <sub>D</sub>	12.6 10	А
Pulsed Drain Current <sup>C</sup>	I <sub>DM</sub>	51	A	
Avalanche Current <sup>c</sup>		I <sub>AS</sub>	20	A
Avalanche Energy <sup>C</sup>	L=0.3mH	E <sub>AS</sub>	60	mJ
Power Dissipation <sup>B</sup>	$T_{A} = +25^{\circ}C$ $T_{A} = +70^{\circ}C$	P <sub>D</sub>	3.1 2	W
Operating and Storage Temper	T <sub>J</sub> , T <sub>G</sub>	-55 to+150	°C	

## **Thermal Characteristic**

Characteristic	Symbol	Тур	Мах	Unit	
Maximum Junction-to-Ambient <sup>A</sup>	t ≤ 10s		35	40	°C/W
Maximum Junction-to-Ambient	Steady-State	κ <sub>θJA</sub>	63	75	°C/W
Maximum Junction-to-Lead	Steady-State	$R_{ ext{ heta}JL}$	18	24	°C/W

## Electrical Characteristics (T<sub>A</sub>=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Тур	Max	Units	
STATIC PARAMETERS							
BV <sub>DSS</sub>	Drain-Source Breakdown Voltage	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V	60			V	
I <sub>DSS</sub>	Zero Gate Voltage Drain Current	V <sub>DS</sub> =60V, V <sub>GS</sub> =0V			1		
		TJ=55℃			5	μΑ	
I <sub>GSS</sub>	Gate-Body leakage current	$V_{DS}=0V, V_{GS}=\pm 20V$			±10	μA	
V <sub>GS(th)</sub>	Gate Threshold Voltage	V <sub>DS</sub> =V <sub>GS</sub> I <sub>D</sub> =250μA	1.2	1.9	3	V	
	Static Drain-Source On-Resistance	V <sub>GS</sub> =10V, I <sub>D</sub> =12.6A		9.1	11.3		
R <sub>DS(ON)</sub>		TJ=125℃		14.2	17.6	mΩ	
		V <sub>GS</sub> =4.5V, I <sub>D</sub> =11.5A		15.4	19	mΩ	
9 <sub>FS</sub>	Forward Trans conductance	V <sub>DS</sub> =5V, I <sub>D</sub> =12.6A		34		S	
V <sub>SD</sub>	Diode Forward Voltage	I <sub>S</sub> =1A,V <sub>GS</sub> =0V		0.74	1	V	
I <sub>S</sub>	Is Maximum Body-Diode Continuous Current				4.1	А	
DYNAMIC F	PARAMETERS						
C <sub>iss</sub>	Input Capacitance			1565		pF	
C <sub>oss</sub>	Output Capacitance	V <sub>GS</sub> =0V, V <sub>DS</sub> =30V, f–1MHz		211		pF	
C <sub>rss</sub>	Reverse Transfer Capacitance	I — I IVII IZ		5		pF	
R <sub>g</sub>	Gate resistance	f=1MHz	0.3	1	1.7	Ω	
SWITCHING PARAMETERS							
Qg	Total Gate Charge			25		nC	
Q <sub>gs</sub>	Gate Source Charge	V <sub>GS</sub> =10V, V <sub>DS</sub> =310V,		7.3		nC	
Q <sub>gd</sub>	Gate Drain Charge	I <sub>D</sub> =12.6A		2.4		nC	
t <sub>D(on)</sub>	Turn-On Delay Time			6.7		ns	
t <sub>r</sub>	Turn-On Rise Time	V <sub>GS</sub> =10V, V <sub>DS</sub> =30V,		28.7		ns	
t <sub>D(off)</sub>	Turn-Off Delay Time	$R_L=2.4\Omega, R_{GEN}=3\Omega$		20.5		ns	
t <sub>f</sub>	Turn-Off Fall Time			6.9		ns	
t <sub>rr</sub>	Body Diode Reverse Recovery Time	I <sub>F</sub> =12.6A, dI/dt=100A/μs		24.9		ns	
Q <sub>rr</sub>	Body Diode Reverse Recovery Charge	I <sub>F</sub> =12.6A, dI/dt=100A/μs		17.8		nC	

A. The value of  $R_{0JA}$  is measured with the device mounted on  $1in^2$  FR-4 board with 1oz. Copper, in a still air environment with  $T_A = 25^{\circ}$ C. The value in any given application depends on the user's specific board design.

B. The power dissipation P\_D is based on T\_{J(MAX)}=150°C, using ≤10s junction-to-ambient thermal resistance.

C. Repetitive rating, pulse width limited by junction temperature  $T_{J(MAX)}$ =150°C. Ratings are based on low frequency and duty cycles to keep initial  $T_{J}$ =25°C.

D. The  $R_{\theta JA}$  is the sum of the thermal impedance from junction to lead  $R_{\theta JL}$  and lead to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300  $\mu s$  pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-ambient thermal impedance which is measured with the device mounted to a larger heatsink, assuming a maximum junction temperature of Tj (max)=150 °C. The SOA curve provides a single pulse rating

G. The maximum current rating is package limited





Figure 1: On-Region Characteristics (Note E)



Figure 3: On-Resistance vs. Drain Current and Gate Voltage (Note E)







Figure 2 Transfer Characteristics (Note E)







Figure 6: Body-Diode Characteristics (Note E)



## **RATING AND CHARACTERISTICS CURVES (RM28N60ES8)**

100us

1m

10n

.00

100



Figure 7: Gate-Charge Characteristics

DC

Drain-Source Voltage(V)

10

100

Drain Current(A)

0.1

0.1



Figure 8: Capacitance Characteristics



Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

Figure 10: Single Pulse Power Rating Junction-to-Ambient (Note F)



Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)



## Gate Charge Test Circuit & Waveform





#### Resistive Switching Test Circuit & Waveforms



## Unclamped Inductive Switching (UIS) Test Circuit & Waveforms





## Diode Recovery Test Circuit & Waveforms





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Symbol	Dimensions I	n Millimeters	Dimensions In Inches		
Symbol	Min.	Max.	Min.	Max.	
А	1.350	1.750	0.053	0.069	
A1	0.100	0.250	0.004	0.010	
A2	1.350	1.550	0.053	0.061	
b	0.330	0.510	0.013	0.020	
С	0.170	0.250	0.006	0.010	
D	4.700	5.100	0.185	0.200	
E	3.800	4.000	0.150	0.157	
E1	5.800	6.200	0.228	0.244	
e	1.270(BSC)		0.050(BSC)		
L	0.400	1.270	0.016	0.050	
θ	0°	8°	0°	8°	

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