## RECTRON SEMICONDUCTOR
### TECHNICAL SPECIFICATION

# RM16P60LD

## 60V P-Channel MOSFETs

### General Description

*These P-Channel enhancement mode power field effect transistors are using trench DMOS technology. This advanced technology has been especially tailored to minimize on-state resistance, provide superior switching performance, and withstand high energy pulse in the avalanche and commutation mode. These devices are well suited for high efficiency fast switching applications.*

| BVDSS | RDSON | ID |
|-------|-------|-----|
| -60V | 48mΩ | -16A |

### Features

- *-60V, -16A, RDS(ON) =48mΩ@VGS = -10V*
- *Improved dv/dt capability*
- *Fast switching*
- *100% EAS Guaranteed*
- *Green Device Available*

### TO252 Pin Configuration
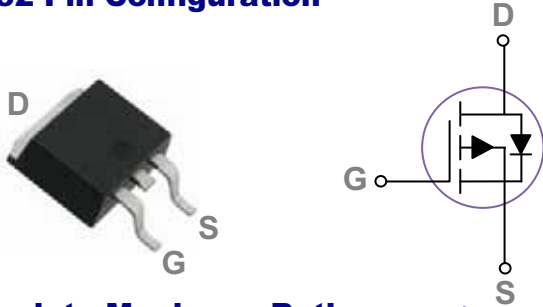


### Applications

- *Motor Drive*
- *Power Tools*
- *LED Lighting*
- *P/N suffix V means AEC-Q101qualified, e.g:RM16P60LDV*
- *P/N suffix V meansHalogen-free*

## Absolute Maximum Ratings Tc=25℃ unless otherwise noted

| Symbol | Parameter | Rating | Units |
|--------|-----------|--------|-------|
| $V_{DS}$ | Drain-Source Voltage | -60 | V |
| $V_{GS}$ | Gate-Source Voltage | ±20 | V |
| $I_D$ | Drain Current – Continuous ($T_C$=25℃) | -16 | A |
| | Drain Current – Continuous ($T_C$=100℃) | -10 | A |
| $I_{DM}$ | Drain Current – Pulsed[1] | -64 | A |
| EAS | Single Pulse Avalanche Energy[2] | 51 | mJ |
| IAS | Single Pulse Avalanche Current[2] | -32 | A |
| $P_D$ | Power Dissipation ($T_C$=25℃) | 25 | W |
| | Power Dissipation – Derate above 25℃ | 0.2 | W/℃ |
| $T_{STG}$ | Storage Temperature Range | -50 to 150 | ℃ |
| $T_J$ | Operating Junction Temperature Range | -50 to 150 | ℃ |

## Thermal Characteristics

| Symbol | Parameter | Typ. | Max. | Unit |
|--------|-----------|------|------|------|
| $R_{\theta JA}$ | Thermal Resistance Junction to ambient | --- | 62 | ℃/W |
| $R_{\theta JC}$ | Thermal Resistance Junction to Case | --- | 5 | ℃/W |

## Electrical Characteristics (T$_J$=25 ℃, unless otherwise noted)

### Off Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| BV$_{DSS}$ | Drain-Source Breakdown Voltage | V$_{GS}$=0V , I$_D$=-250uA | -60 | --- | --- | V |
| $\triangle$BV$_{DSS}$/$\triangle$T$_J$ | BV$_{DSS}$ Temperature Coefficient | Reference to 25℃ , I$_D$=-1mA | --- | -0.05 | --- | V/℃ |
| I$_{DSS}$ | Drain-Source Leakage Current | V$_{DS}$=-60V , V$_{GS}$=0V , T$_J$=25℃ | --- | --- | -1 | uA |
| | | V$_{DS}$=-48V , V$_{GS}$=0V , T$_J$=125℃ | --- | --- | -10 | uA |
| I$_{GSS}$ | Gate-Source Leakage Current | V$_{GS}$=$\pm$20V , V$_{DS}$=0V | --- | --- | $\pm$100 | nA |

### On Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| R$_{DS(ON)}$ | Static Drain-Source On-Resistance | V$_{GS}$=-10V , I$_D$=-8A | --- | 39 | 48 | m$\Omega$ |
| | | V$_{GS}$=-4.5V , I$_D$=-4A | --- | 53 | 65 | m$\Omega$ |
| V$_{GS(th)}$ | Gate Threshold Voltage | V$_{GS}$=V$_{DS}$ , I$_D$=-250uA | -1.2 | -1.6 | -2.2 | V |
| $\triangle$V$_{GS(th)}$ | V$_{GS(th)}$ Temperature Coefficient | | --- | 5 | --- | mV/℃ |
| gfs | Forward Transconductance | V$_{DS}$=-10V , I$_D$=-8A | --- | 10 | --- | S |

### Dynamic and switching Characteristics

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| Q$_g$ | Total Gate Charge[3,4] | V$_{DS}$=-30V , V$_{GS}$=-10V , I$_D$=-8A | --- | 22.4 | 31 | nC |
| Q$_{gs}$ | Gate-Source Charge[3,4] | | --- | 4.1 | 6 | |
| Q$_{gd}$ | Gate-Drain Charge[3,4] | | --- | 5.2 | 7 | |
| T$_{d(on)}$ | Turn-On Delay Time[3,4] | V$_{DD}$=-30V , V$_{GS}$=-10V , R$_G$=6$\Omega$ I$_D$=-1A | --- | 13 | 25 | ns |
| T$_r$ | Rise Time[3,4] | | --- | 42.4 | 81 | |
| T$_{d(off)}$ | Turn-Off Delay Time[3,4] | | --- | 64.6 | 123 | |
| T$_f$ | Fall Time[3,4] | | --- | 16.4 | 31 | |
| C$_{iss}$ | Input Capacitance | V$_{DS}$=-30V , V$_{GS}$=0V , F=1MHz | --- | 1250 | 1810 | pF |
| C$_{oss}$ | Output Capacitance | | --- | 85 | 125 | |
| C$_{rss}$ | Reverse Transfer Capacitance | | --- | 65 | 95 | |
| R$_g$ | Gate resistance | V$_{GS}$=0V, V$_{DS}$=0V, F=1MHz | --- | 15 | 30 | $\Omega$ |

### Drain-Source Diode Characteristics and Maximum Ratings

| Symbol | Parameter | Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| I$_S$ | Continuous Source Current | V$_G$=V$_D$=0V , Force Current | --- | --- | -16 | A |
| I$_{SM}$ | Pulsed Source Current | | --- | --- | -64 | A |
| V$_{SD}$ | Diode Forward Voltage | V$_{GS}$=0V , I$_S$=-1A , T$_J$=25℃ | --- | --- | -1 | V |
| t$_{rr}$ | Reverse Recovery Time[3] | V$_{GS}$=0V,I$_S$=-1A , dI/dt=100A/μs | --- | --- | --- | ns |
| Q$_{rr}$ | Reverse Recovery Charge[3] | T$_J$=25℃ | --- | --- | --- | nC |

Note :
1. Repetitive Rating : Pulsed width limited by maximum junction temperature.
2. V$_{DD}$=-25V,V$_{GS}$=-10V,L=0.1mH,I$_{AS}$=-32A.,R$_G$=25$\Omega$, Starting T$_J$=25℃
3. The data tested by pulsed , pulse width $\leqq$ 300us , duty cycle $\leqq$ 2%.
4. Essentially independent of operating temperature.

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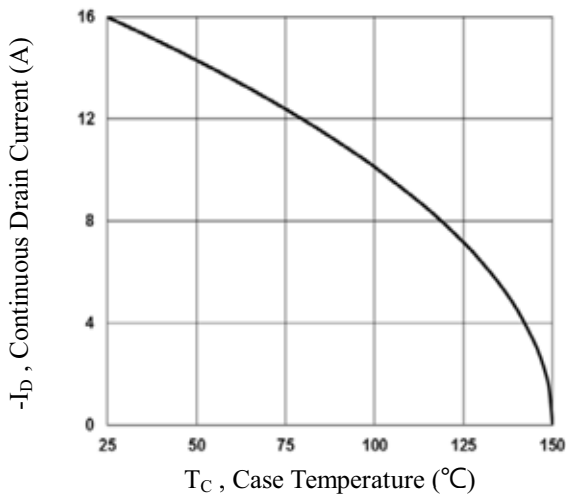# RATING AND CHARACTERISTICS CURVES (RM16P60LD)
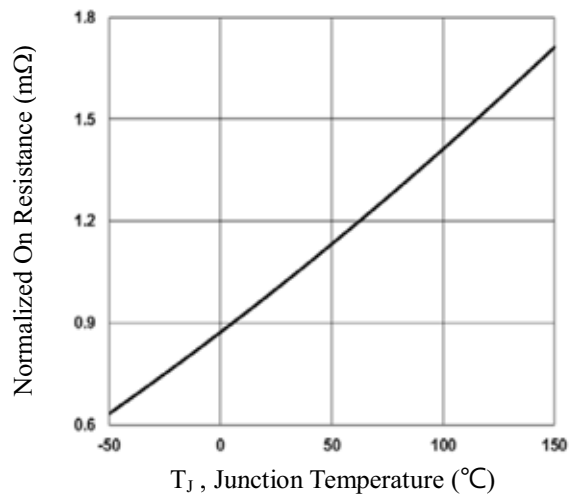

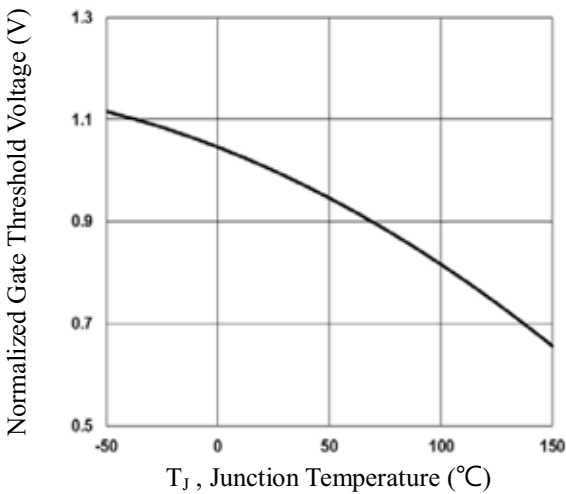**Fig.1 Continuous Drain Current vs. T$_C$**


**Fig.2 Normalized RDSON vs. T$_J$**


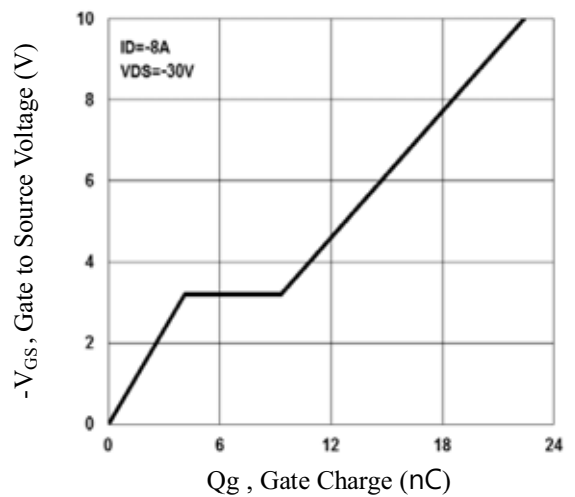**Fig.3 Normalized V$_{th}$ vs. T$_J$**


**Fig.4 Gate Charge Waveform**
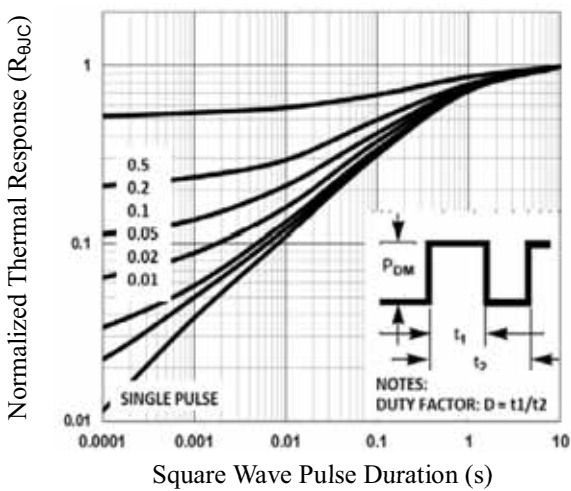

**Fig.5 Normalized Transient Impedance**
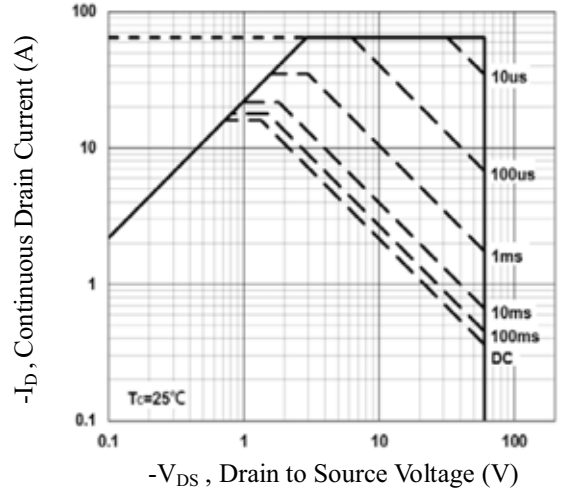

**Fig.6 Maximum Safe Operation Area**
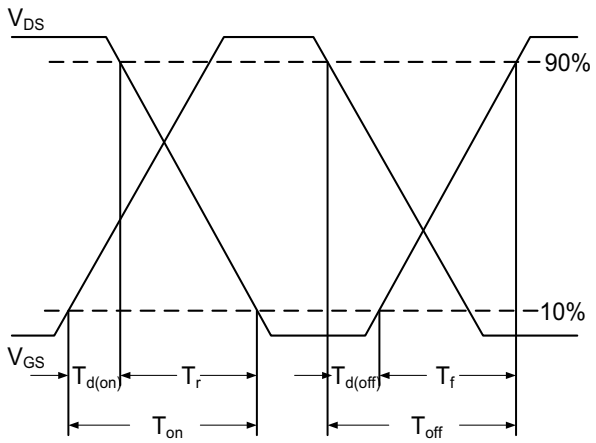
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**Fig.7  Switching Time Waveform**

$$EAS = \frac{1}{2} L \times (-I_{AS})^2 \times \frac{-BVDSS}{-BVDSS-(-VDD)}$$
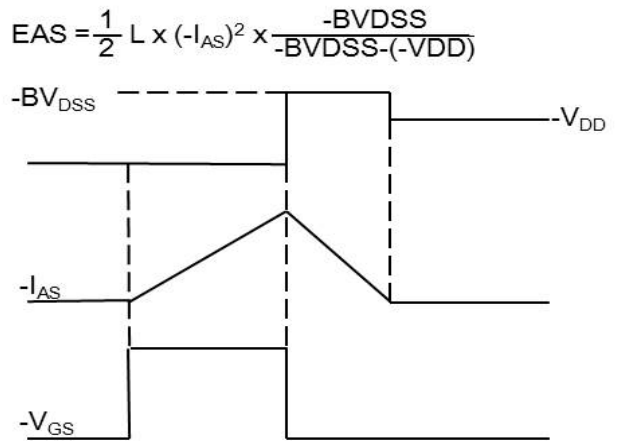


**Fig.8  EAS Waveform**

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**Marking on the body**
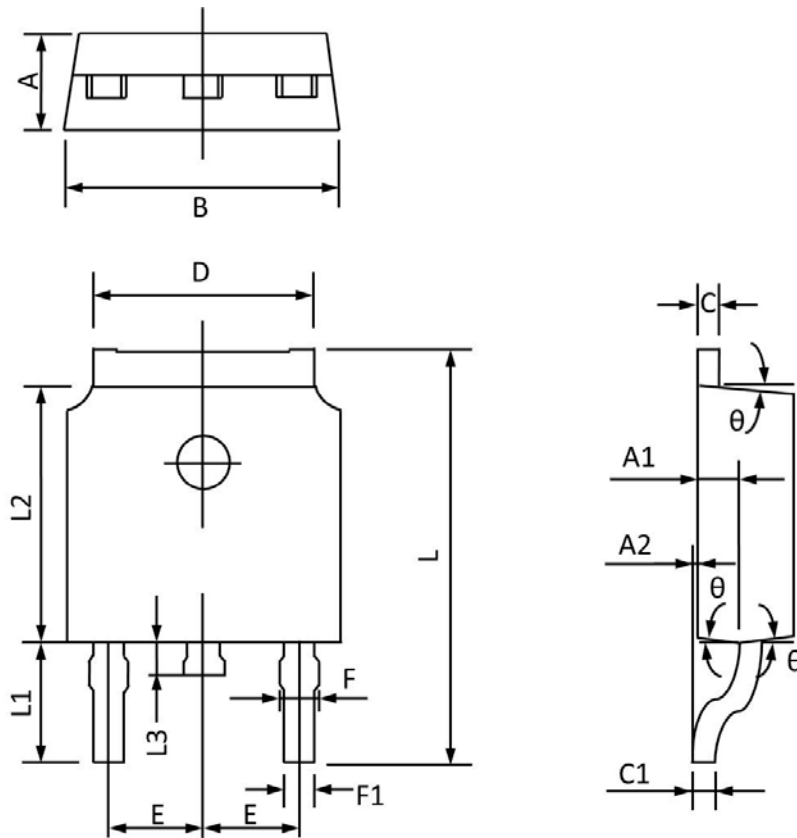
Rectron Logo

**1 6 P 6 0** ← Part No.

**Y Y W W**

Year – Code
(Y:17-----2017
  18-----2018.....)

Week – code
(WW:01~52)

# TO252 PACKAGE INFORMATION



| Symbol | Dimensions In Millimeters | | Dimensions In Inches | |
|--------|------|------|------|------|
| | Min | Max | Min | Max |
| A | 2.20 | 2.40 | 0.087 | 0.094 |
| A1 | 0.91 | 1.11 | 0.036 | 0.044 |
| A2 | 0.00 | 0.15 | 0.000 | 0.006 |
| B | 6.50 | 6.70 | 0.256 | 0.264 |
| C | 0.46 | 0.580 | 0.018 | 0.230 |
| C1 | 0.46 | 0.580 | 0.018 | 0.030 |
| D | 5.10 | 5.46 | 0.201 | 0.215 |
| E | 2.186 | 2.386 | 0.086 | 0.094 |
| F | 0.74 | 0.94 | 0.029 | 0.037 |
| F1 | 0.660 | 0.860 | 0.026 | 0.034 |
| L | 9.80 | 10.40 | 0.386 | 0.409 |
| L1 | 2.9REF | | 0.114REF | |
| L2 | 6.00 | 6.20 | 0.236 | 0.244 |
| L3 | 0.60 | 1.00 | 0.024 | 0.039 |
| θ | 3° | 9° | 3° | 9° |

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