

# High Voltage Power MOSFET

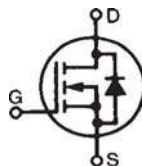
## IXTX1R4N450HV

$$V_{DSS} = 4500V$$

$$I_{D25} = 1.4A$$

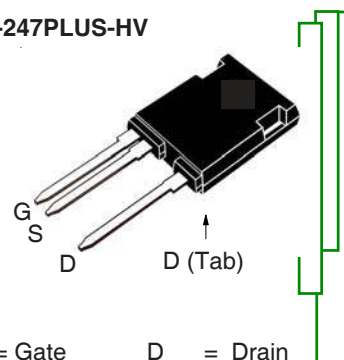
$$R_{DS(on)} \leq 40\Omega$$

N-Channel Enhancement Mode



| Symbol        | Test Conditions   | Maximum Ratings   |                  |
|---------------|---|-------------------|------------------|
| $V_{DSS}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$                       | 4500              | V                |
| $V_{DGR}$     | $T_J = 25^\circ\text{C}$ to $150^\circ\text{C}$ , $R_{GS} = 1M\Omega$ | 4500              | V                |
| $V_{GSS}$     | Continuous  | $\pm 20$          | V                |
| $V_{GSM}$     | Transient   | $\pm 30$          | V                |
| $I_{D25}$     | $T_C = 25^\circ\text{C}$  | 1.4               | A                |
| $I_{DM}$      | $T_C = 25^\circ\text{C}$ , Pulse Width Limited by $T_{JM}$            | 5.0               | A                |
| $P_D$         | $T_C = 25^\circ\text{C}$  | 960               | W                |
| $T_J$         |   | - 55 ... +150     | $^\circ\text{C}$ |
| $T_{JM}$      |   | 150               | $^\circ\text{C}$ |
| $T_{stg}$     |   | - 55 ... +150     | $^\circ\text{C}$ |
| $T_L$         | Maximum Lead Temperature for Soldering                                | 300               | $^\circ\text{C}$ |
| $T_{SOLD}$    | 1.6 mm (0.062in.) from Case for 10s                                   | 260               | $^\circ\text{C}$ |
| $M_d$         | Mounting Force  | 20..120 / 4.5..27 | Nm/lb.in         |
| <b>Weight</b> |   | 6                 | g                |

TO-247PLUS-HV



G = Gate      D = Drain  
S = Source    Tab = Drain

### Features

- High Blocking Voltage
- High Voltage Package

### Advantages

- Easy to Mount
- Space Savings
- High Power Density

### Applications

- High Voltage Power Supplies
- Capacitor Discharge Applications
- Pulse Circuits
- Laser and X-Ray Generation Systems

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)                        | Characteristic Values |      |                  |
|--------------|--|-----------------------|------|------------------|
|              |  | Min.                  | Typ. | Max.             |
| $V_{GS(th)}$ | $V_{DS} = V_{GS}$ , $I_D = 250\mu\text{A}$   | 4.0                   |      | 6.0 V            |
| $I_{GSS}$    | $V_{GS} = \pm 20V$ , $V_{DS} = 0V$   |                       |      | $\pm 100$ nA     |
| $I_{DSS}$    | $V_{DS} = 3.6kV$ , $V_{GS} = 0V$<br>$V_{DS} = 4.5kV$<br>$V_{DS} = 3.6kV$ $T_J = 125^\circ\text{C}$ |                       |      | 5 $\mu\text{A}$  |
|              |  |                       |      | 25 $\mu\text{A}$ |
|              |  |                       | 50   | $\mu\text{A}$    |
| $R_{DS(on)}$ | $V_{GS} = 10V$ , $I_D = 50mA$ , Note 1   |                       |      | 40 $\Omega$      |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)   | Characteristic Values |      |                         |
|--------------|---|-----------------------|------|-------------------------|
|              |   | Min.                  | Typ. | Max.                    |
| $g_{fs}$     | $V_{DS} = 50\text{V}$ , $I_D = 0.7\text{A}$ , Note 1  | 1.2                   | 2.0  | S                       |
| $C_{iss}$    | } $V_{GS} = 0\text{V}$ , $V_{DS} = 25\text{V}$ , $f = 1\text{MHz}$  |                       | 3300 | pF                      |
| $C_{oss}$    |   |                       | 134  | pF                      |
| $C_{rss}$    |   |                       | 52   | pF                      |
| $R_{Gi}$     | Gate Input Resistance   |                       | 7.8  | $\Omega$                |
| $t_{d(on)}$  | } <b>Resistive Switching Times</b><br>$V_{GS} = 10\text{V}$ , $V_{DS} = 500\text{V}$ , $I_D = 0.7\text{A}$<br>$R_G = 10\Omega$ (External) |                       | 44   | ns                      |
| $t_r$        |   |                       | 60   | ns                      |
| $t_{d(off)}$ |   |                       | 126  | ns                      |
| $t_f$        |   |                       | 170  | ns                      |
| $Q_{g(on)}$  | } $V_{GS} = 10\text{V}$ , $V_{DS} = 0.5 \cdot V_{DSS}$ , $I_D = 0.7\text{A}$  |                       | 88   | nC                      |
| $Q_{gs}$     |   |                       | 16   | nC                      |
| $Q_{gd}$     |   |                       | 42   | nC                      |
| $R_{thJC}$   |   |                       |      | 0.13 $^\circ\text{C/W}$ |
| $R_{thCS}$   |   | 0.15                  |      | $^\circ\text{C/W}$      |

**Source-Drain Diode**

| Symbol   | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified)     | Characteristic Values |      |               |
|----------|---|-----------------------|------|---------------|
|          |   | Min.                  | Typ. | Max.          |
| $I_S$    | $V_{GS} = 0\text{V}$ , Note 1   |                       |      | 1.4 A         |
| $I_{SM}$ | Repetitive, pulse Width Limited by $T_{JM}$                                     |                       |      | 5.6 A         |
| $V_{SD}$ | $I_F = I_S$ , $V_{GS} = 0\text{V}$ , Note 1                                     |                       |      | 1.5 V         |
| $t_{rr}$ | } $I_F = 1\text{A}$ , $-di/dt = 100\text{A}/\mu\text{s}$<br>$V_R = 100\text{V}$ |                       | 660  | ns            |
| $Q_{RM}$ |   |                       | 4.6  | $\mu\text{C}$ |
| $I_{RM}$ |   |                       | 14.0 | A             |

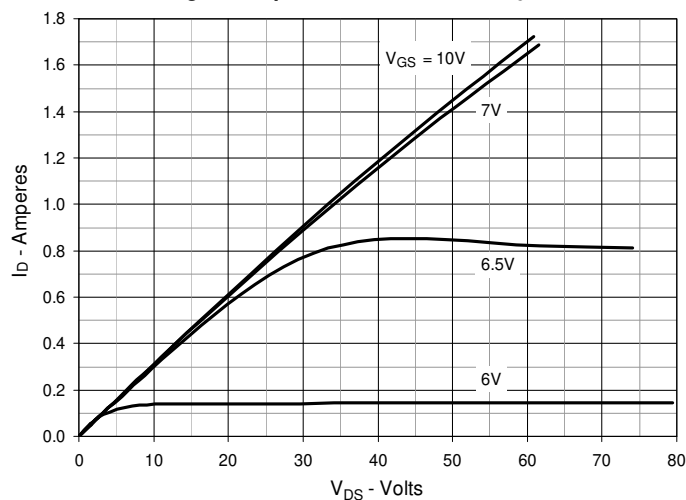
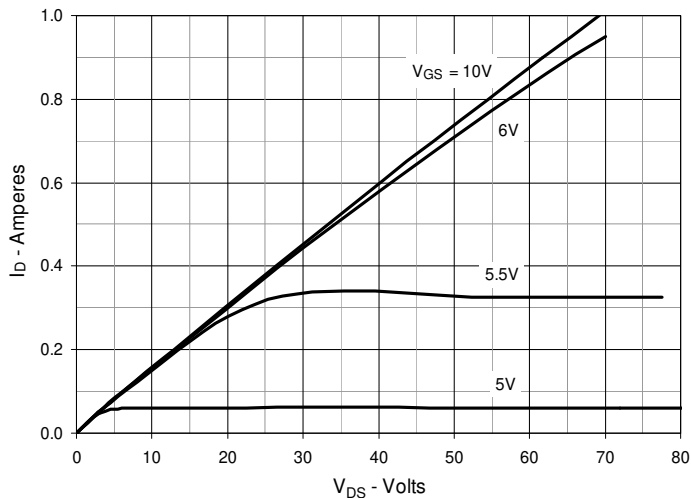
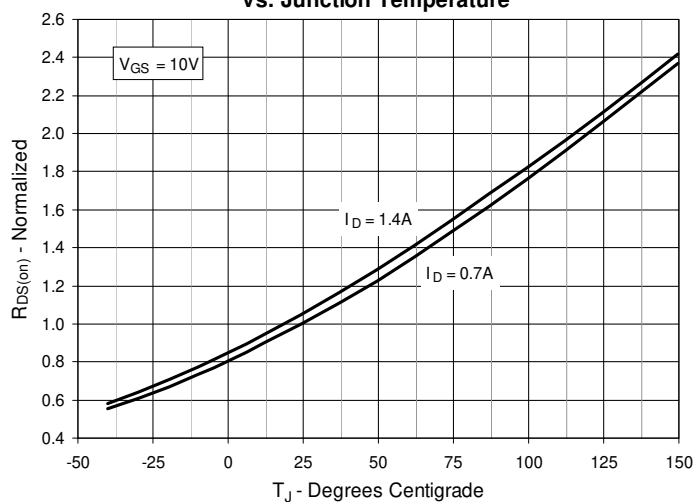
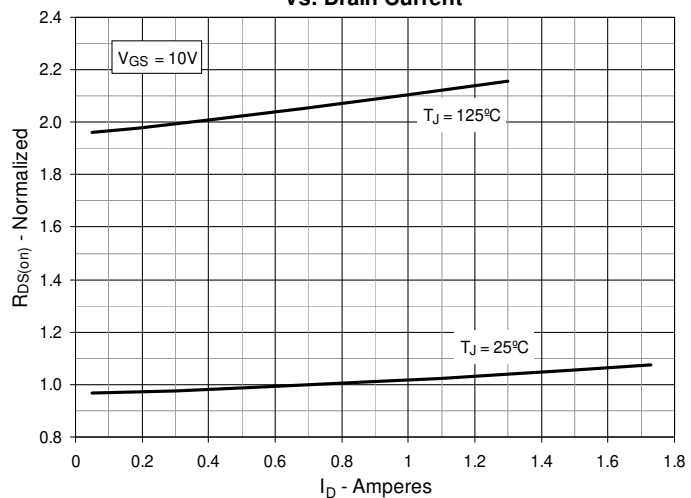
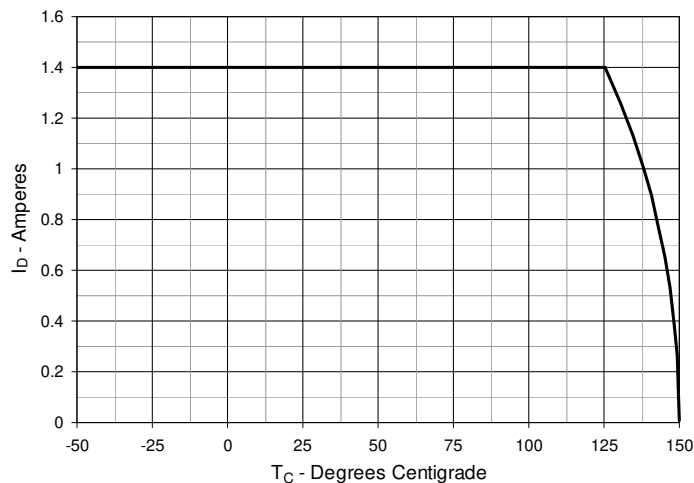
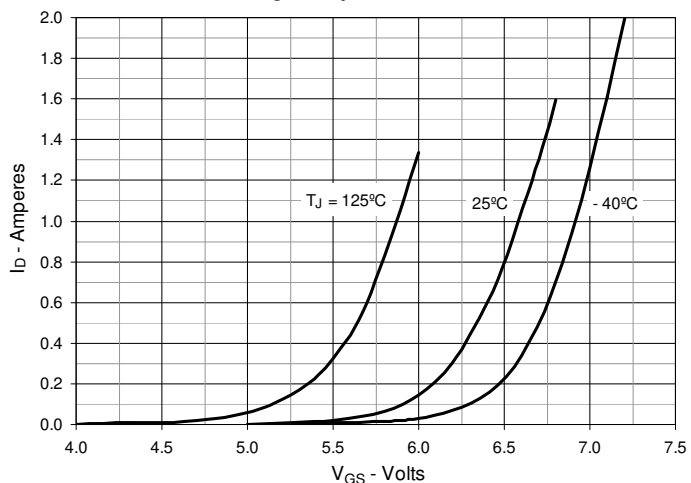
Note: 1. Pulse test,  $t \leq 300\mu\text{s}$ , duty cycle,  $d \leq 2\%$ .

**ADVANCE TECHNICAL INFORMATION**

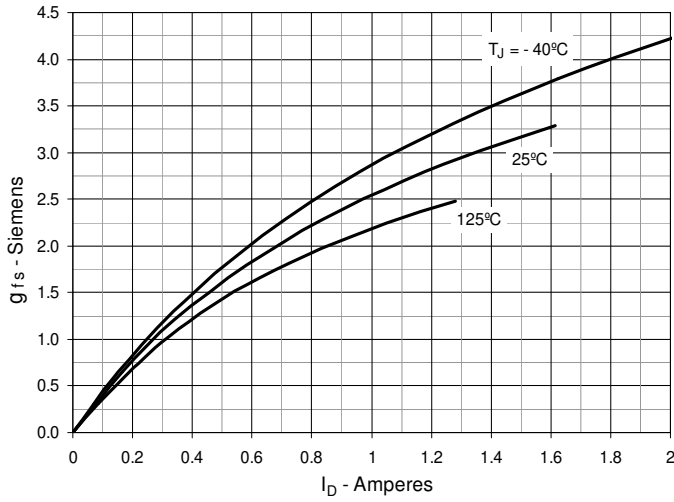
The product presented herein is under development. The Technical Specifications offered are derived from a subjective evaluation of the design, based upon prior knowledge and experience, and constitute a "considered reflection" of the anticipated result. IXYS reserves the right to change limits, test conditions, and dimensions without notice.

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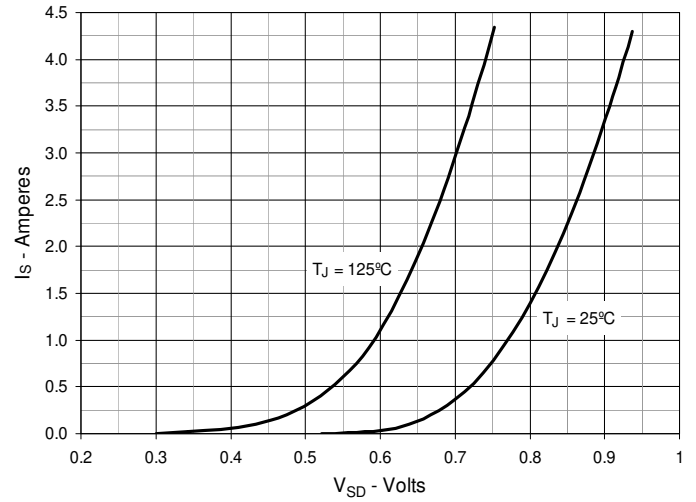
|   |           |           |           |           |              |              |              |              |              |             |
|---|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and IGBTs are covered            | 4,835,592 | 4,931,844 | 5,049,961 | 5,237,481 | 6,162,665    | 6,404,065 B1 | 6,683,344    | 6,727,585    | 7,005,734 B2 | 7,157,338B2 |
| by one or more of the following U.S. patents: | 4,860,072 | 5,017,508 | 5,063,307 | 5,381,025 | 6,259,123 B1 | 6,534,343    | 6,710,405 B2 | 6,759,692    | 7,063,975 B2 |             |
|   | 4,881,106 | 5,034,796 | 5,187,117 | 5,486,715 | 6,306,728 B1 | 6,583,505    | 6,710,463    | 6,771,478 B2 | 7,071,537    |             |

**Fig. 1. Output Characteristics @  $T_J = 25^\circ\text{C}$** 

**Fig. 2. Output Characteristics @  $T_J = 125^\circ\text{C}$** 

**Fig. 3.  $R_{DS(on)}$  Normalized to  $I_D = 0.7\text{A}$  Value vs. Junction Temperature**

**Fig. 4.  $R_{DS(on)}$  Normalized to  $I_D = 0.7\text{A}$  Value vs. Drain Current**

**Fig. 5. Maximum Drain Current vs. Case Temperature**

**Fig. 6. Input Admittance**


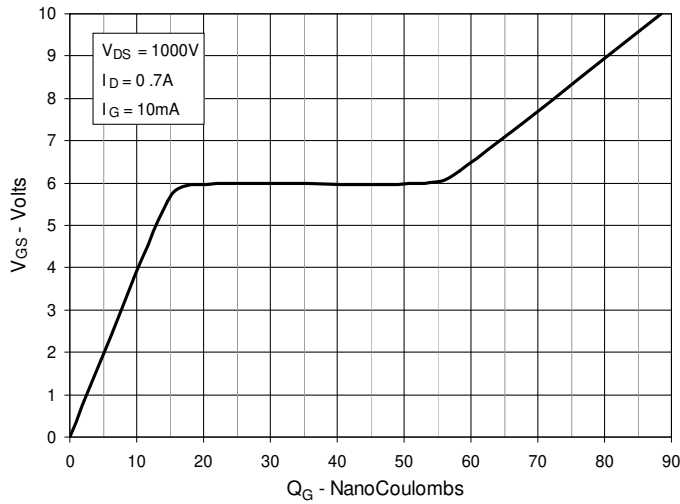
**Fig. 7. Transconductance**



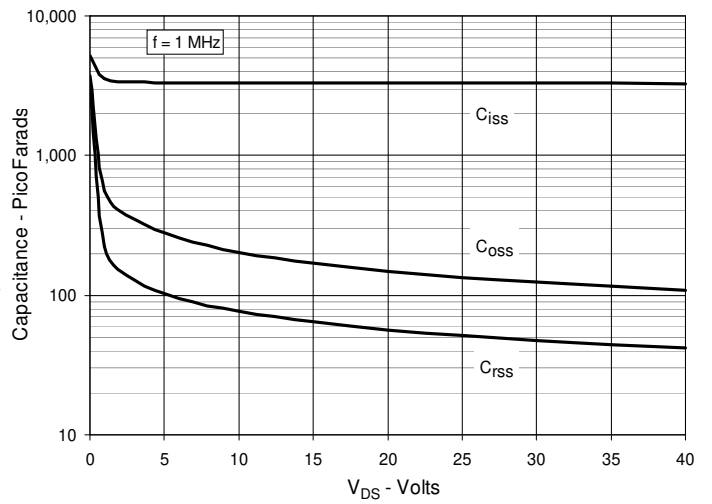
**Fig. 8. Forward Voltage Drop of Intrinsic Diode**



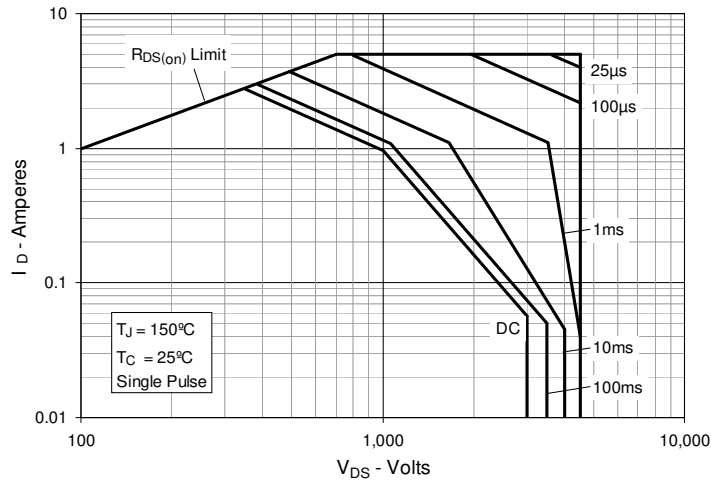
**Fig. 9. Gate Charge**



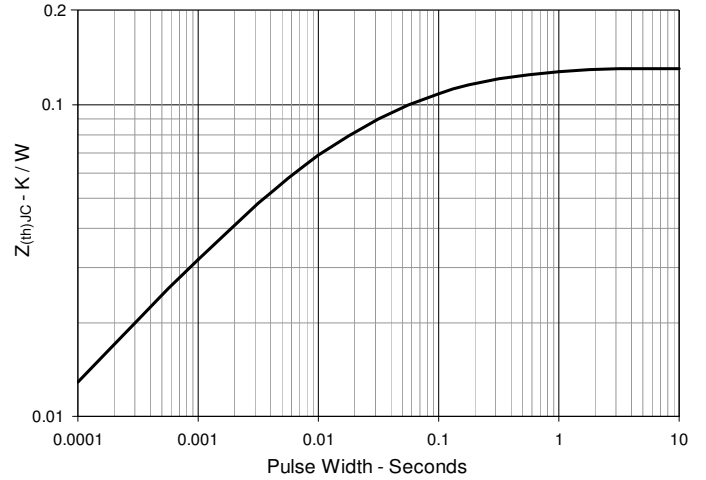
**Fig. 10. Capacitance**

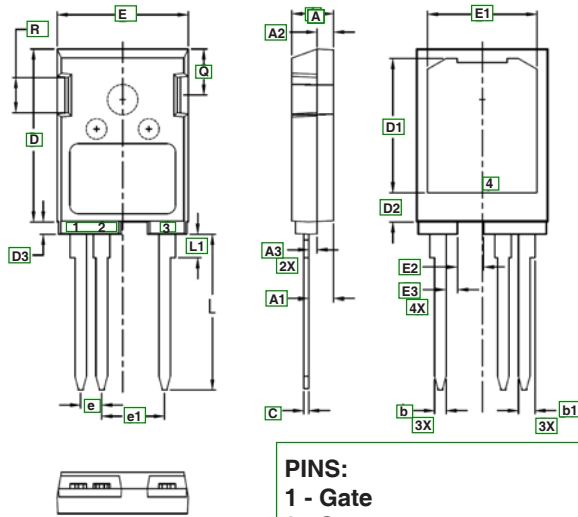


**Fig. 11. Forward-Bias Safe Operating Area**



**Fig. 12. Maximum Transient Thermal Impedance**



**TO-247PLUS HV OUTLINE**


**PINS:**  
 1 - Gate  
 2 - Source  
 3,4 - Drain

| SYM | INCHES   |      | MILLIMETERS |       |
|-----|----------|------|-------------|-------|
|     | MIN      | MAX  | MIN         | MAX   |
| A   | .193     | .201 | 4.90        | 5.10  |
| A1  | .114     | .122 | 2.90        | 3.10  |
| A2  | .075     | .083 | 1.90        | 2.10  |
| A3  | .035     | .043 | 0.90        | 1.10  |
| b   | .053     | .059 | 1.35        | 1.50  |
| b1  | .075     | .083 | 1.90        | 2.10  |
| c   | .022     | .030 | 0.55        | 0.75  |
| D   | .819     | .843 | 20.80       | 21.40 |
| D1  | .638     | .646 | 16.20       | 16.40 |
| D2  | .134     | .146 | 3.40        | 3.70  |
| D3  | .055     | .063 | 1.40        | 1.60  |
| E   | .622     | .638 | 15.80       | 16.20 |
| E1  | .520     | .528 | 13.20       | 13.40 |
| E2  | .118     | .126 | 3.00        | 3.20  |
| E3  | .051     | .059 | 1.30        | 1.50  |
| e   | .100 BSC |      | 2.54 BSC    |       |
| e1  | .300 BSC |      | 7.62 BSC    |       |
| L   | .732     | .748 | 18.60       | 19.00 |
| L1  | .106     | .118 | 2.70        | 3.00  |
| Q   | .216     | .224 | 5.50        | 5.70  |
| R   | .165     | .169 | 4.20        | 4.30  |



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