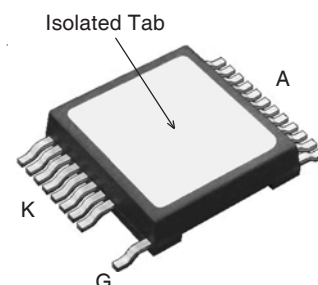
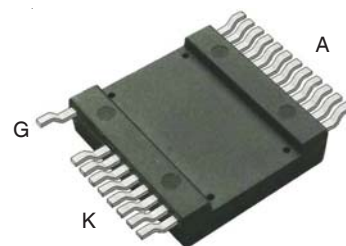


# 1500V MOS Gated Thyristor w/ Anti-Parallel Diode

MMIX1H60N150V1

 $V_{DM} = 1500V$ 

(Electrically Isolated Tab)



G = Gate  
A = Anode

K = Cathode

| Symbol     | Test Conditions                                | Maximum Ratings |                  |
|------------|------------------------------------------------|-----------------|------------------|
| $V_{DM}$   | $T_J = 25^\circ\text{C to } 150^\circ\text{C}$ | 1500            | V                |
| $V_{GK}$   | Continuous                                     | $\pm 30$        | V                |
| $V_{GK}$   | Transient                                      | $\pm 40$        | V                |
| $I_{TSM}$  | $T_C = 25^\circ\text{C}, 1\mu\text{s}$         | 32.0            | kA               |
|            | $T_C = 25^\circ\text{C}, 10\mu\text{s}$        | 11.8            | kA               |
| $P_D$      | $T_C = 25^\circ\text{C}$                       | 446             | 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 (0.062 in.) from Case for 10s           | 260             | $^\circ\text{C}$ |
| $V_{ISOL}$ | 50/60Hz, 1 minute                              | 2500            | V~               |
| $F_C$      | Mounting Force                                 | 50..200/11..45  | N/lb             |
| Weight     |                                                | 8               | g                |

| Symbol       | Test Conditions<br>( $T_J = 25^\circ\text{C}$ , Unless Otherwise Specified) | Characteristic Values |      |                            |
|--------------|-----------------------------------------------------------------------------|-----------------------|------|----------------------------|
|              |                                                                             | Min.                  | Typ. | Max.                       |
| $V_{BR}$     | $I_A = 250\mu\text{A}, V_{GK} = 0V$                                         | 1500                  |      | V                          |
| $V_{GK(th)}$ | $I_A = 250\mu\text{A}, V_{AK} = V_{GK}$                                     | 2.5                   |      | 5.0 V                      |
| $V_T$        | $I_T = 1000A, V_{GK} = 15V$                                                 |                       | 4.6  | 6.0 V                      |
| $r_T$        | $I_T > I_L, V_{GK} = 15V$                                                   |                       | 1.2  | m $\Omega$                 |
| $V_{BO}$     | $V_{GK} = 15V$                                                              |                       | 4.8  | V                          |
| $I_D$        | $V_{AK} = 1500V, V_{GK} = 0V$<br>$T_J = 125^\circ\text{C}$                  |                       |      | 15 $\mu\text{A}$<br>1.5 mA |
| $I_L$        |                                                                             |                       | 400  | A                          |
| $I_H$        |                                                                             |                       | 350  | A                          |
| $I_{GKS}$    | $V_{AK} = 0V, V_{GK} = \pm 30V$                                             |                       |      | $\pm 200$ nA               |

## Features

- Silicon Chip on Direct-Copper Bond (DCB) Substrate
- Isolated Mounting Surface
- Anti-Parallel Diode
- 2500V~ Electrical Isolation
- Very High Current Capability

## Advantages

- High Power Density
- Low Gate Drive Requirement

## Applications

- Capacitive Discharge Circuits
- Ignition Circuits
- Solid State Surge Protection

**Symbol Test Conditions**
 $(T_J = 25^\circ\text{C Unless Otherwise Specified})$ 
**Characteristic Values**
**Min.      Typ.      Max.**

|                                        |                                                                                                                                                                    |                   |                                              |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------------|
| $C_{iks}$<br>$C_{oks}$<br>$C_{rks}$    | $\left. \begin{array}{l} \\ \\ \end{array} \right\} V_{AK} = 25V, V_{GK} = 0V, f = 1\text{MHz}$                                                                    | 5120<br>340<br>84 | pF<br>pF<br>pF                               |
| $Q_{g(on)}$<br>$Q_{gk}$<br>$Q_{ga}$    | $\left. \begin{array}{l} \\ \\ \end{array} \right\} I_C = 60A, V_{GK} = 15V, V_{AK} = 600V$                                                                        | 180<br>33<br>62   | nC<br>nC<br>nC                               |
| $t_{ri}$<br>$t_d$                      | <b>Capacitive Discharge, <math>T_J = 25^\circ\text{C}</math></b><br>$I_A = 2000A, V_{GK} = 15V, R_G = 1\Omega$<br>$V_{AK} = 1000V, L < 20nH, \text{Notes 2 \& 3}$  | 100<br>50         | ns<br>ns                                     |
| $t_{ri}$<br>$t_d$                      | <b>Capacitive Discharge, <math>T_J = 125^\circ\text{C}</math></b><br>$I_A = 2000A, V_{GK} = 15V, R_G = 1\Omega$<br>$V_{AK} = 1000V, L < 20nH, \text{Notes 2 \& 3}$ | 100<br>50         | ns<br>ns                                     |
| $R_{thJC}$<br>$R_{thCS}$<br>$R_{thJA}$ |                                                                                                                                                                    | <br>0.05<br>19    | <br>$^\circ\text{C/W}$<br>$^\circ\text{C/W}$ |

**Reverse Diode (FRED)**
**Symbol Test Conditions**
 $(T_J = 25^\circ\text{C Unless Otherwise Specified})$ 
**Characteristic Values**
**Min.      Typ.      Max.**

|                      |                                                                                                                  |           |                         |
|----------------------|------------------------------------------------------------------------------------------------------------------|-----------|-------------------------|
| $V_F$                | $I_F = 100A, V_{GK} = 0V, \text{Note 1}$                                                                         |           | 1.8      V              |
| $I_{RM}$<br>$t_{rr}$ | $\left. \begin{array}{l} \\ \end{array} \right\} I_F = 50A, V_{GK} = 0V,$<br>$-di_F/dt = 200A/\mu s, V_R = 300V$ | 20<br>700 | A<br>ns                 |
| $R_{thJC}$           |                                                                                                                  |           | 0.50 $^\circ\text{C/W}$ |

**Notes:**

1. Pulse test,  $t \leq 300\mu s$ , duty cycle,  $d \leq 2\%$ .
2. It is recommended to use a gate driver capable of supplying more than 4Amps and  $\geq 15V$  gate voltage.
3. Refer to fig. 9 & 10.

**PRELIMINARY 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.

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.

|                                                                                  |           |           |           |           |              |              |              |              |              |             |
|----------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|--------------|--------------|--------------|--------------|--------------|-------------|
| IXYS MOSFETs and IGBTs are covered by one or more of the following U.S. patents: | 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 |
|                                                                                  | 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    |             |

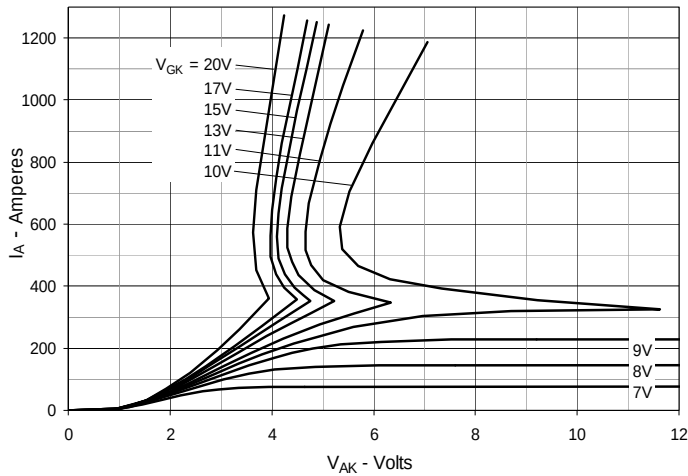
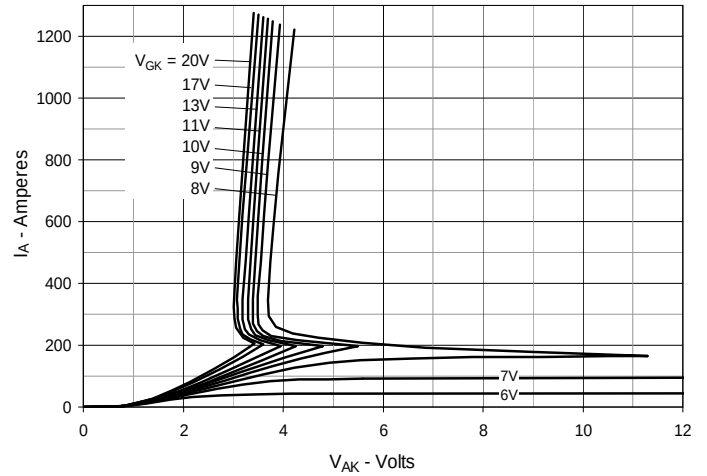
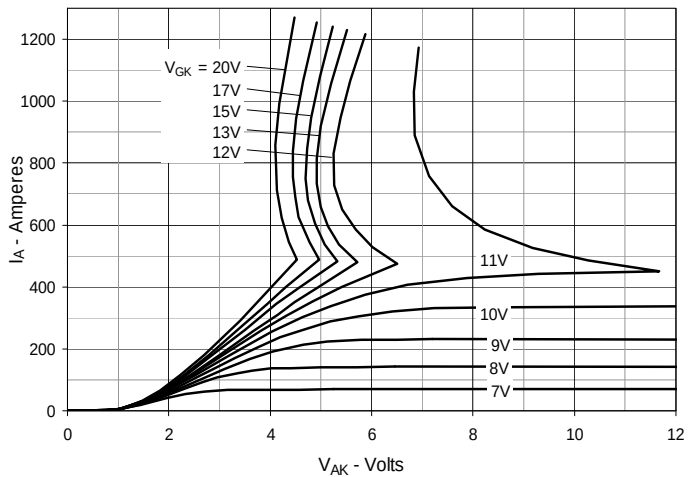
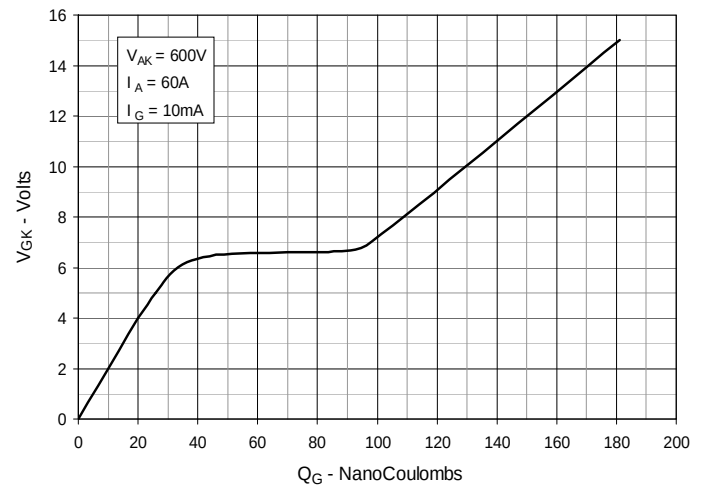
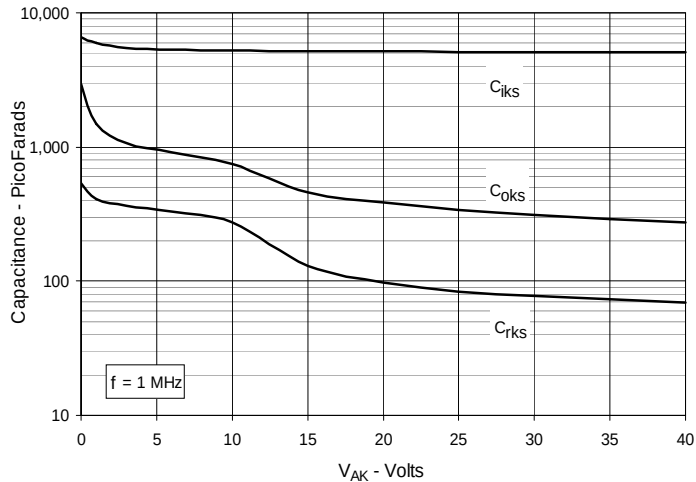
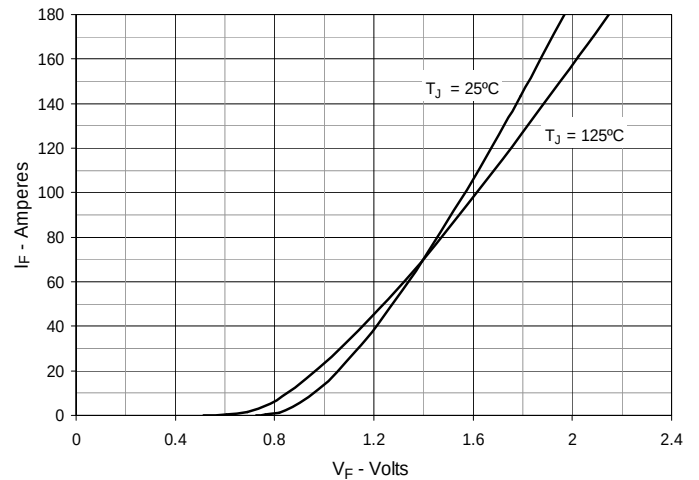
**Fig. 1. Extended Output Characteristics @  $T_J = 25^\circ\text{C}$** 

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

**Fig. 3. Extended Output Characteristics @  $T_J = -40^\circ\text{C}$** 

**Fig. 4. Gate Charge**

**Fig. 5. Capacitance**

**Fig. 6. Forward Voltage Drop of Intrinsic Diode**


Fig. 7. Maximum Transient Thermal Impedance

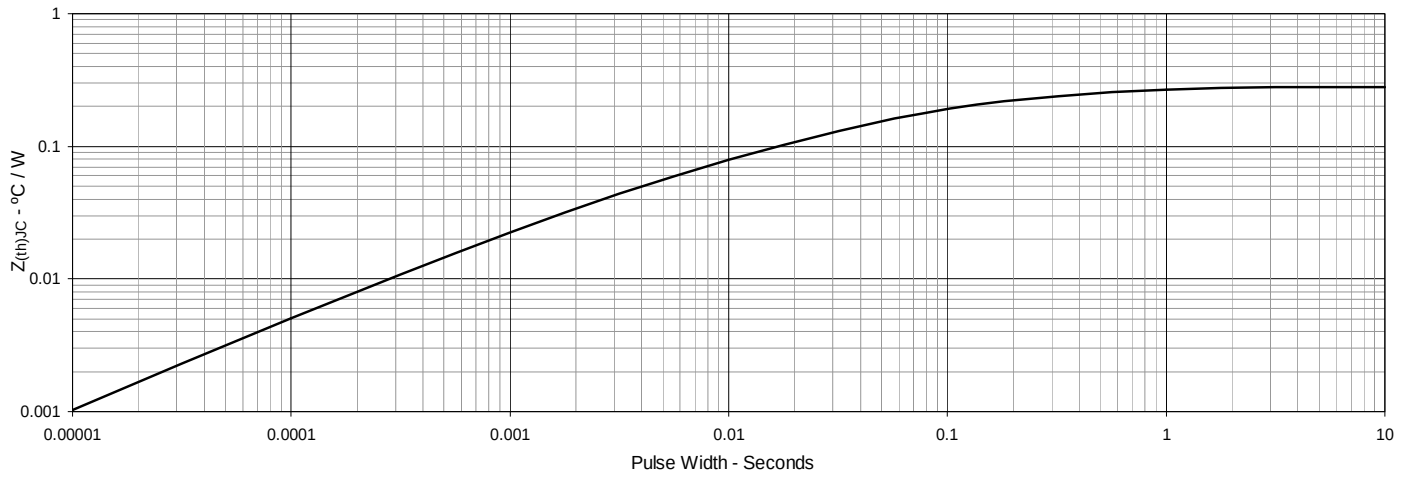
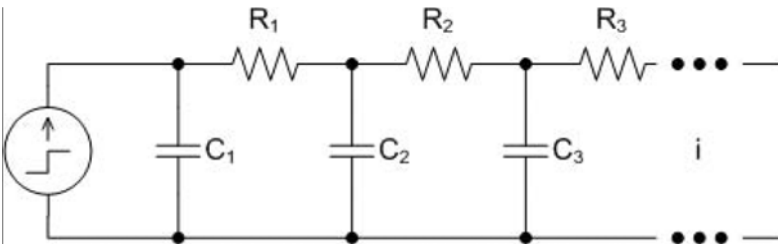


Fig. 8. Cauer Thermal Network



| i | $R_i$ ( $\Omega$ ) | $C_i$ (F) |
|---|--------------------|-----------|
| 1 | 0.018327           | 0.024851  |
| 2 | 0.052439           | 0.058268  |
| 3 | 0.099100           | 0.208110  |
| 4 | 0.048364           | 4.000000  |

Fig. 9. Capacitive Discharge Circuit

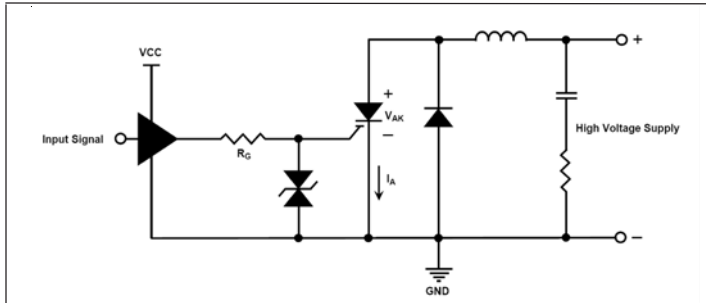
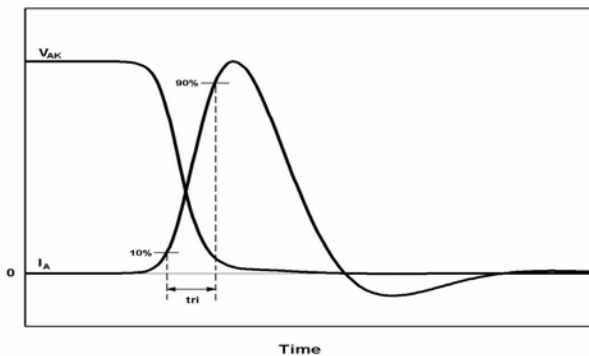
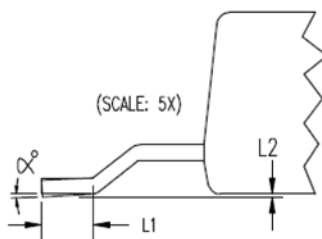
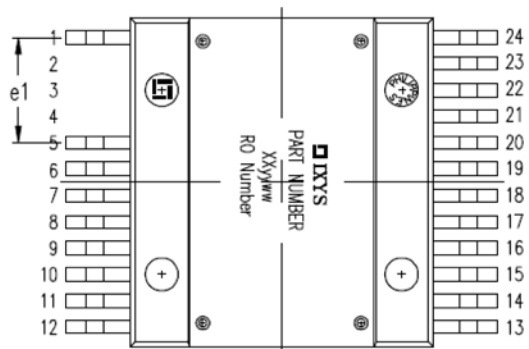
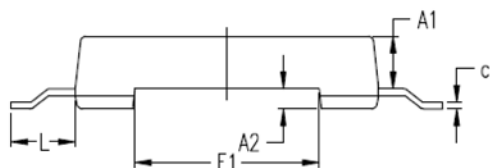
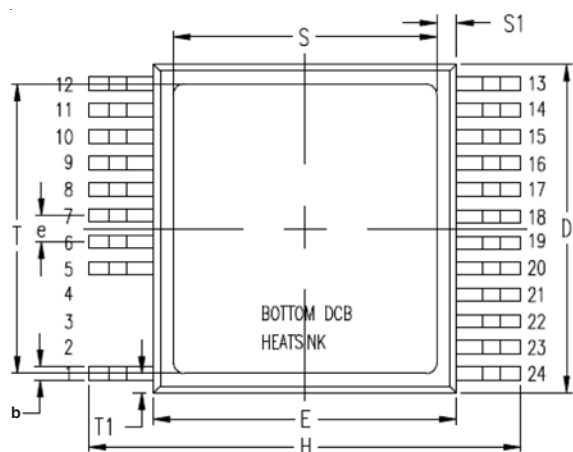


Fig. 10. Capacitive Discharge Waveform





PIN: 1 = Gate  
5-12 = Cathode  
13-24 = Anode

| Dim. | Millimeter |       | Inches |       |
|------|------------|-------|--------|-------|
|      | min        | max   | min    | max   |
| A    | 5.30       | 5.70  | 0.209  | 0.224 |
| A1   | 3.90       | 4.10  | 0.154  | 0.161 |
| A2   | 1.40       | 1.60  | 0.055  | 0.063 |
| b    | 0.90       | 1.15  | 0.035  | 0.045 |
| c    | 0.45       | 0.65  | 0.018  | 0.026 |
| D    | 24.80      | 25.25 | 0.976  | 0.994 |
| E    | 22.80      | 23.25 | 0.898  | 0.915 |
| E1   | 13.80      | 14.20 | 0.543  | 0.559 |
| e    | 2.00       | BSC   | 0.079  | BSC   |
| e1   | 8.00       | BSC   | 0.315  | BSC   |
| H    | 32.30      | 33.30 | 1.272  | 1.311 |
| L    | 4.60       | 5.30  | 0.181  | 0.209 |
| L1   | 1.30       | 1.70  | 0.051  | 0.067 |
| L2   | 0.00       | 0.15  | 0.000  | 0.006 |
| S    | 18.85      | 20.12 | 0.742  | 0.792 |
| S1   | 1.45       | 2.08  | 0.057  | 0.082 |
| T    | 20.90      | 22.17 | 0.823  | 0.873 |
| T1   | 1.42       | 2.03  | 0.056  | 0.080 |
| a    | 4°         | -     | 4°     | -     |



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