IXYS

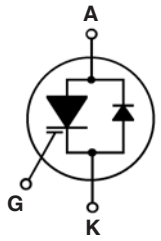
Preliminary Technical Information

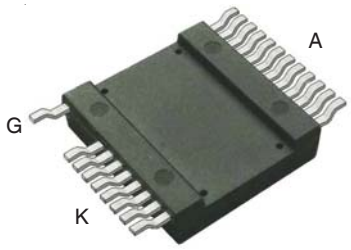
# 1500V MOS Gated Thyristor w/ Anti-Parallel Diode

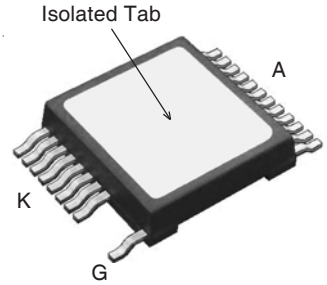
**MMIX1H60N150V1**

**$V_{DM}$ = 1500V**

**(Electrically Isolated Tab)**




G = Gate K = Cathode
A = Anode

| Symbol | Test Conditions | Maximum Ratings | |
|---|---|---|---|
| $V_{DM}$ | $T_J$ = 25°C to 150°C | 1500 | V |
| $V_{GK}$ | Continuous | ±30 | V |
| $V_{GK}$ | Transient | ±40 | V |
| $I_{TSM}$ | $T_C$ = 25°C, 1µs | 32.0 | kA |
| | $T_C$ = 25°C, 10µs | 11.8 | kA |
| $P_D$ | $T_C$ = 25°C | 446 | W |
| $T_J$ | | -55 ... +150 | °C |
| $T_{JM}$ | | 150 | °C |
| $T_{stg}$ | | -55 ... +150 | °C |
| $T_L$ | Maximum Lead Temperature for Soldering | 300 | °C |
| $T_{SOLD}$ | 1.6 mm (0.062 in.) from Case for 10s | 260 | °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 ($T_J$ = 25°C, Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $V_{BR}$ | $I_A$ = 250µA, $V_{GK}$ = 0V | 1500 | | | V |
| $V_{GK(th)}$ | $I_A$ = 250µA, $V_{AK}$ = $V_{GK}$ | 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 | | mΩ |
| $V_{BO}$ | $V_{GK}$ = 15V | | 4.8 | | V |
| $I_D$ | $V_{AK}$ = 1500V, $V_{GK}$ = 0V | | | 15 | µA |
| | $T_J$ = 125°C | | | 1.5 | mA |
| $I_L$ | | | 400 | | A |
| $I_H$ | | | 350 | | A |
| $I_{GKS}$ | $V_{AK}$ = 0V, $V_{GK}$ = ±30V | | | ±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°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $C_{iks}$ | $V_{AK}$ = 25V, $V_{GK}$ = 0V, f = 1MHz | | 5120 | | pF |
| $C_{oks}$ | | | 340 | | pF |
| $C_{rks}$ | | | 84 | | pF |
| $Q_{g(on)}$ | $I_C$ = 60A, $V_{GK}$ = 15V, $V_{AK}$ = 600V | | 180 | | nC |
| $Q_{gk}$ | | | 33 | | nC |
| $Q_{ga}$ | | | 62 | | nC |
| $t_{ri}$ | **Capacitive Discharge, $T_J$ = 25°C** | | 100 | | ns |
| $t_d$ | $I_A$ = 2000A, $V_{GK}$ = 15V, $R_G$ = 1Ω, $V_{AK}$ = 1000V, L < 20nH, Notes 2 & 3 | | 50 | | ns |
| $t_{ri}$ | **Capacitive Discharge, $T_J$ = 125°C** | | 100 | | ns |
| $t_d$ | $I_A$ = 2000A, $V_{GK}$ = 15V, $R_G$ = 1Ω, $V_{AK}$ = 1000V, L < 20nH, Notes 2 & 3 | | 50 | | ns |
| $R_{thJC}$ | | | | 0.28 | °C/W |
| $R_{thCS}$ | | | 0.05 | | °C/W |
| $R_{thJA}$ | | | 19 | | °C/W |

**Reverse Diode (FRED)**

| Symbol | Test Conditions (TJ = 25°C Unless Otherwise Specified) | Characteristic Values Min. | Typ. | Max. | |
|---|---|---|---|---|---|
| $V_F$ | $I_F$ = 100A, $V_{GK}$ = 0V, Note 1 | | | 1.8 | V |
| $I_{RM}$ | $I_F$ = 50A, $V_{GK}$ = 0V, $-di_F/dt$ = 200A/μs, $V_R$ = 300V | | 20 | | A |
| $t_{rr}$ | | | 700 | | ns |
| $R_{thJC}$ | | | | 0.50 | °C/W |

Notes:

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

**PRELIMANARY 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.

**Fig. 1. Extended Output Characteristics @ $T_J$ = 25ºC**

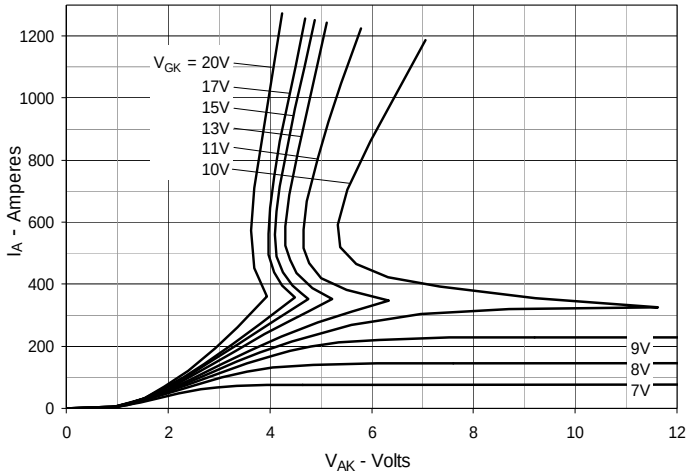



**Fig. 2. Extended Output Characteristics @ $T_J$ = 125ºC**

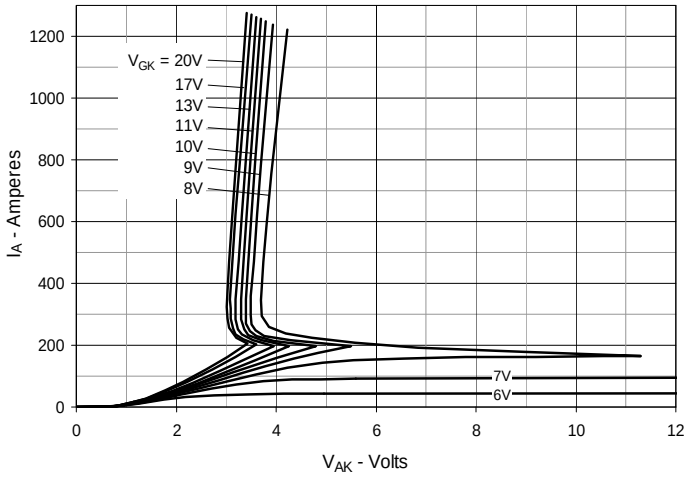



**Fig. 3. Extended Output Characteristics @ $T_J$ = - 40ºC**

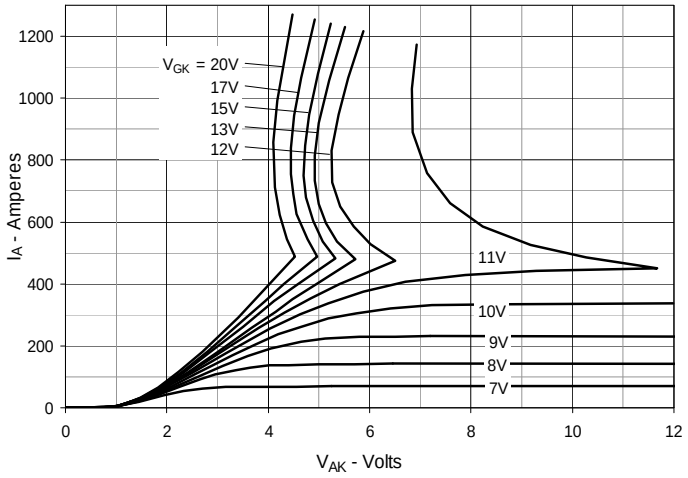



**Fig. 4. Gate Charge**

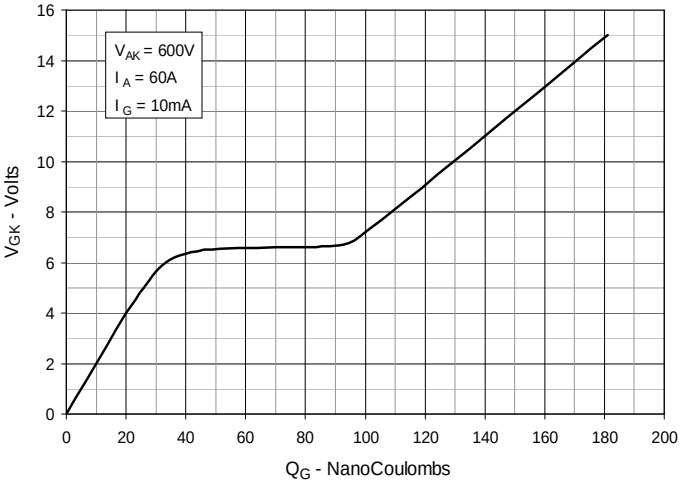



**Fig. 5. Capacitance**

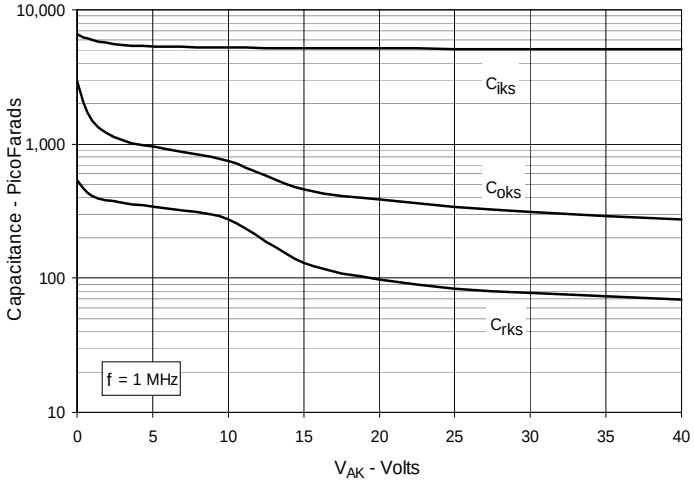



**Fig. 6. Forward Voltage Drop of Intrinsic Diode**

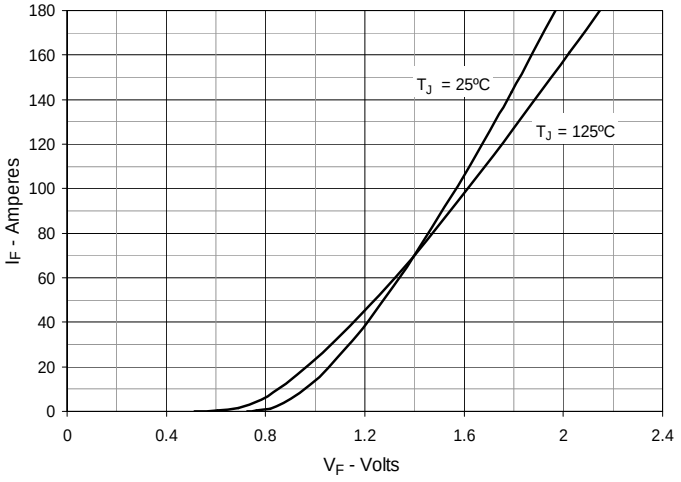


**Fig. 7. Maximum Transient Thermal Impedance**

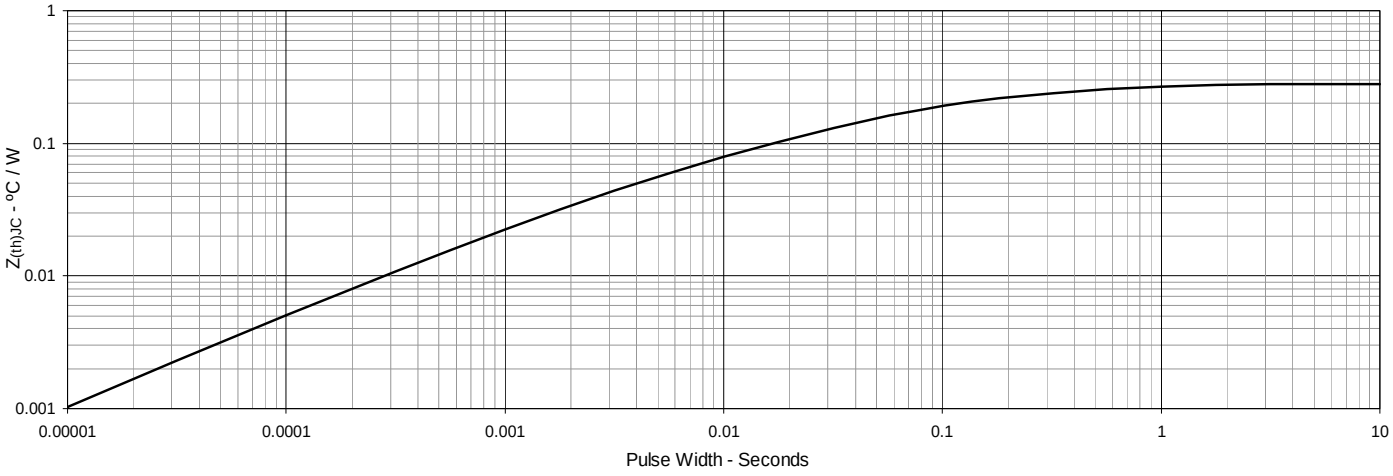
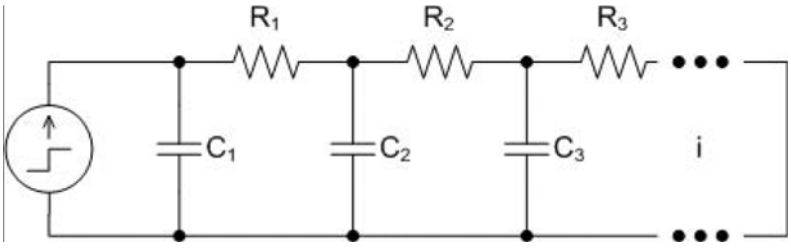



**Fig. 8. Cauer Thermal Network**




| i | Ri (Ω) | Ci (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**

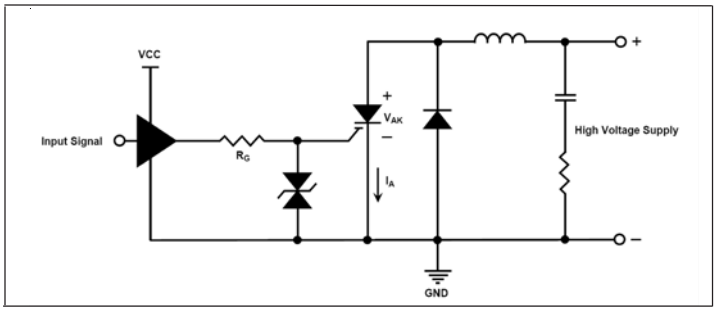
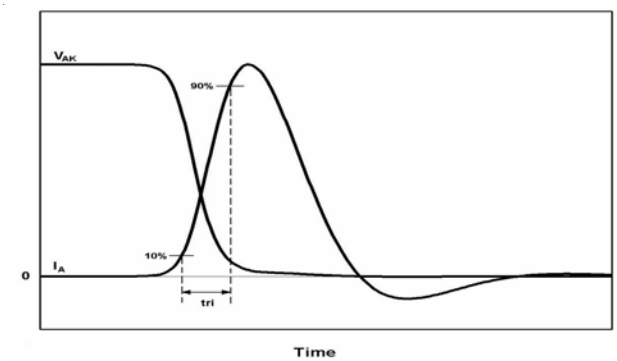
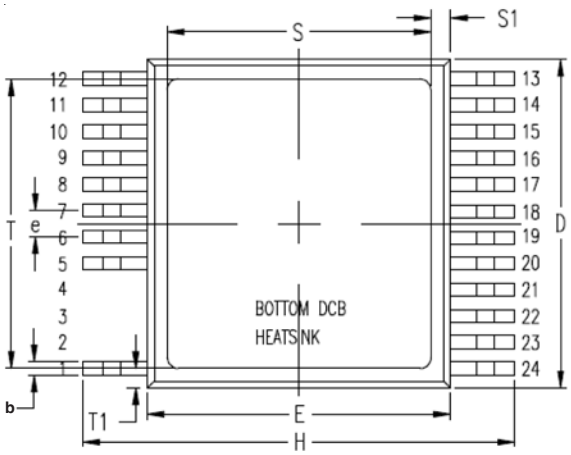
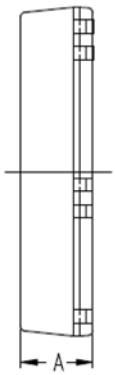


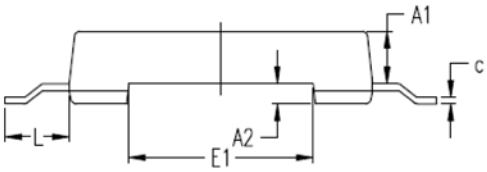

**Fig. 10. Capacitive Discharge Waveform**

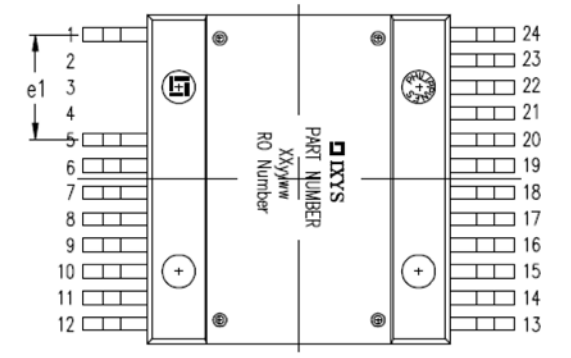


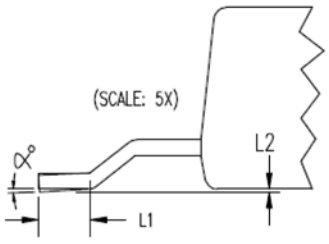

IXYS Reserves the Right to Change Limits, Test Conditions, and Dimensions.




**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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