# ☞ SGS-THOMSON MICROELECTRONICS

# MTP3055A
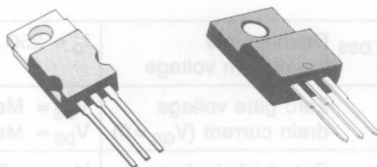# MTP3055AFI

## N - CHANNEL ENHANCEMENT MODE POWER MOS TRANSISTORS

| TYPE | $V_{DSS}$ | $R_{DS(on)}$ | $I_D$ ■ |
|------|-----------|--------------|---------|
| MTP3055A | 60 V | 0.15 Ω | 12 A |
| MTP3055AFI | 60 V | 0.15 Ω | 10 A |

- ULTRA FAST SWITCHING - UP TO > 100KHz
- LOW DRIVE ENERGY FOR EASY DRIVE REDUCES SIZE AND COST
- INTEGRAL SOURCE - DRAIN DIODE

**INDUSTRIAL APPLICATIONS:**
- GENERAL PURPOSE SWITCH
- SERIES REGULATOR

N - channel enhancement mode POWER MOS field effect transistors. Easy drive and very fast times make these POWER MOS transistors ideal for high speed switching circuit in applications such as power actuator driving, motor drive including brushless motors, robotics, actuators lamp driving, series regulator and many other uses in industrial control applications. They also find use in DC/DC converters and uninterruptible power supplies.

TO-220    ISOWATT220

**INTERNAL SCHEMATIC DIAGRAM**
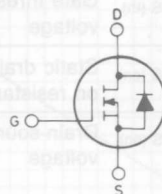
## ABSOLUTE MAXIMUM RATINGS

|  |  | TO-220 ISOWATT220 | MTP3055A MTP3055AFI | | |
|--|--|--------------------|---------------------|--|--|
| $V_{DS}$ | Drain-source voltage ($V_{GS} = 0$) | | 60 | | V |
| $V_{DGR}$ | Drain-gate voltage ($R_{GS} = 20$ KΩ) | | 60 | | V |
| $V_{GS}$ | Gate-source voltage | | ±20 | | V |
| $I_{DM}$ | Drain current (pulsed) | | 26 | | A |
| $I_{GM}$ | Gate current (pulsed) | | 1.5 | | A |
|  |  |  | TO-220 | ISOWATT220 | |
| $I_D$ ■ | Drain current (continuous) | | 12 | 10 | A |
| $P_{tot}$ ■ | Total dissipation at $T_c < 25°C$ | | 40 | 30 | W |
| ■ | Derating factor | | 0.32 | 0.24 | W/°C |
| $T_{stg}$ | Storage temperature | | − 65 to 150 | | °C |
| $T_j$ | Max. operating junction temperature | | 150 | | °C |

■ See note on ISOWATT220 in this datasheet

**THERMAL DATA** ▪ | | | TO-220 | ISOWATT220 |

| | | | | | |
|---|---|---|---|---|---|
| $R_{thj - case}$ | Thermal resistance junction-case | max | 3.12 | 4.16 | °C/W |
| $T_l$ | Maximum lead temperature for soldering purpose | max | 275 | | °C |

**ELECTRICAL CHARACTERISTICS** ($T_{case} = 25°C$ unless otherwise specified)

| | Parameters | Test Conditions | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|
| **OFF** | | | | | | |
| $V_{(BR) DSS}$ | Drain-source breakdown voltage | $I_D = 250 \mu A$      $V_{GS} = 0$ | 60 | | | V |
| $I_{DSS}$ | Zero gate voltage drain current ($V_{GS} = 0$) | $V_{DS}$ = Max Rating<br>$V_{DS}$ = Max Rating x 0.8   $T_c = 125°C$ | | | 50<br>1000 | $\mu A$<br>$\mu A$ |
| $I_{GSS}$ | Gate-body leakage current ($V_{DS} = 0$) | $V_{GS} = \pm 20$ V | | | $\pm 100$ | nA |
| **ON \*** | | | | | | |
| $V_{GS (th)}$ | Gate threshold voltage | $V_{DS} = V_{GS}$   $I_D = 1$ mA<br>$V_{DS} = V_{GS}$   $I_D = 1$ mA   $T_c = 100°C$ | 2<br>1.5 | | 4.5<br>4 | V<br>V |
| $R_{DS (on)}$ | Static drain-source on resistance | $V_{GS} = 10$ V   $I_D = 6$ A | | 0.15 | | $\Omega$ |
| $V_{DS (on)}$ | Drain-source on voltage | $V_{GS} = 10$ V   $I_D = 12$ A<br>$V_{GS} = 10$ V   $I_D = 6$ A<br>$V_{GS} = 10$ V   $I_D = 6$ A   $T_c = 100°C$ | | | 2.0<br>0.9<br>1.5 | V<br>V<br>V |
| **DYNAMIC** | | | | | | |
| $g_{fs}$\* | Forward transconductance | $V_{DS} = 10$ V   $I_D = 6$ A | 4.5 | | | mho |
| $C_{iss}$<br>$C_{oss}$<br>$C_{rss}$ | Input capacitance<br>Output capacitance<br>Reverse transfer capacitance | $V_{DS} = 25$ V<br>$V_{GS} = 0$      $f = 1$ MHz | | | 500<br>200<br>100 | pF<br>pF<br>pF |
| $Q_g$ | Total gate charge | $V_{DS} = 48$ V   $I_D = 12A$<br>$V_{GS} = 10$ V | | | 17 | nC |
| **SWITCHING** | | | | | | |
| $t_{d (on)}$<br>$t_r$<br>$t_{d (off)}$<br>$t_f$ | Turn-on time<br>Rise time<br>Turn-off delay time<br>Fall time | $V_{DD} = 25$ V   $I_D = 6$ A<br>$R_{gen} = 50 \Omega$ | | | 20<br>60<br>65<br>65 | ns<br>ns<br>ns<br>ns |

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## ELECTRICAL CHARACTERISTICS (Continued)

| Parameters | | Test Conditions | | Min. | Typ. | Max. | Unit |
|---|---|---|---|---|---|---|---|
| **SOURCE DRAIN DIODE** | | | | | | | |
| $V_{SD}$ | Forward on voltage | $I_{SD} = 12$ A | $V_{GS} = 0$ | | | 2 | V |
| $t_{rr}$ | Reverse recovery time | $I_{SD} = 12$ A | $V_{GS} = 0$ | | | 75 | ns |

\* Pulsed: Pulse duration $\leqslant 300 \mu s$, duty cycle $\leqslant 2\%$
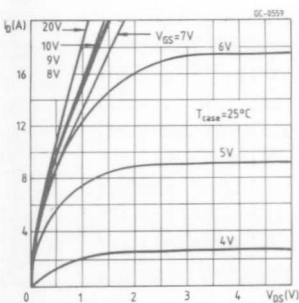■ See note on ISOWATT220 in this datasheet

Safe operating areas
(standard package)
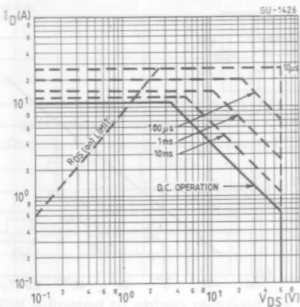


Thermal impedance
(standard package)
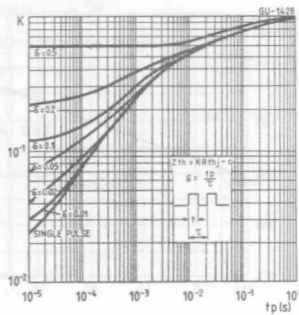


Derating curve
(standard package)
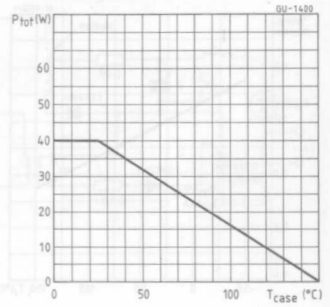


Output characteristics



Transfer characteristics
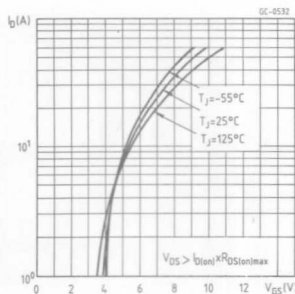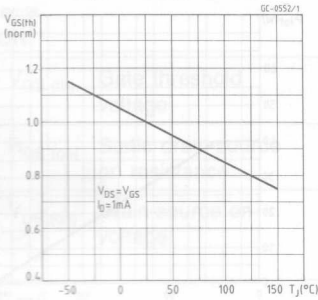


Transconductance
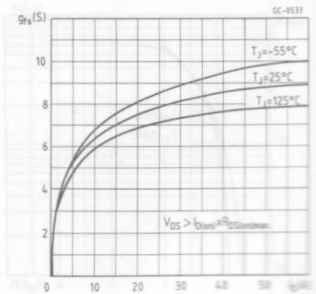
**Static drain-source on resistance**
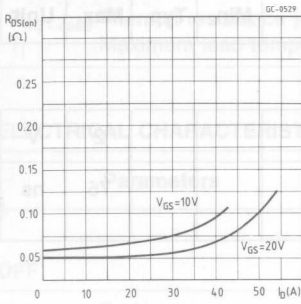


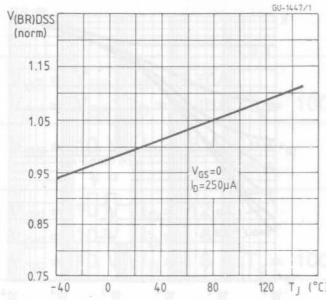**Gate charge vs gate-source voltage**
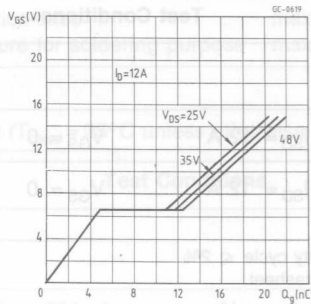

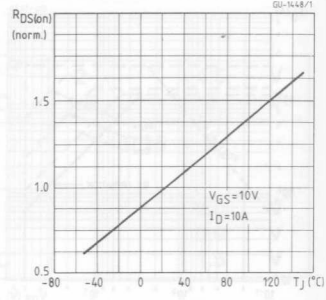
**Capacitance variation**
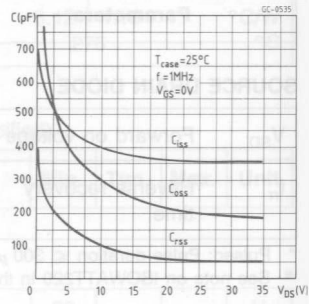


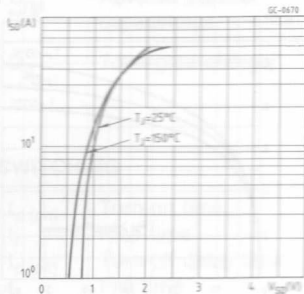**Normalized gate threshold voltage vs temperature**



**Normalized breakdown voltage vs temperature**



**Normalized on resistance vs temperature**
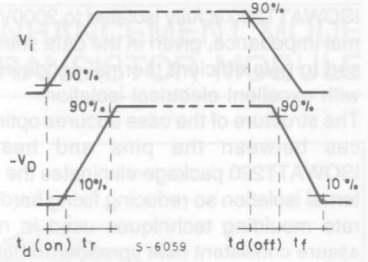


**Source-drain diode forward characteristics**

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Switching times test circuit for resistive load
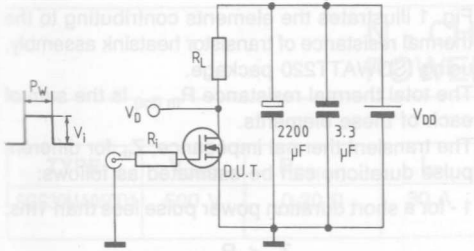


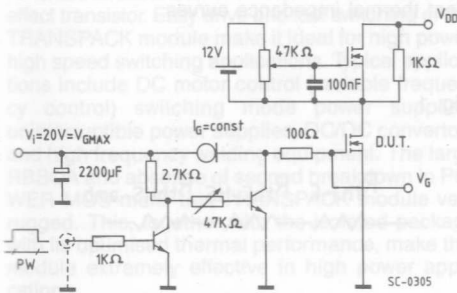Pulse width $\leqslant 100\ \mu s$
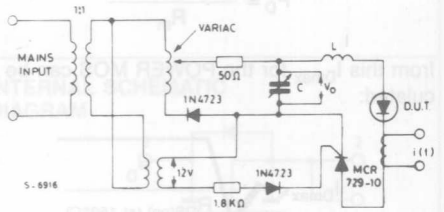Duty cycle $\leqslant 2\%$

Switching time waveforms for resistive load



Gate charge test circuit



PW adjusted to obtain required $V_G$

Body-drain diode $t_{rr}$ measurement
Jedec test circuit

## ISOWATT220 PACKAGE CHARACTERISTICS AND APPLICATION.

ISOWATT220 is fully isolated to 2000V dc. Its thermal impedance, given in the data sheet, is optimised to give efficient thermal conduction together with excellent electrical isolation.

The structure of the case ensures optimum distances between the pins and heatsink. The ISOWATT220 package eliminates the need for external isolation so reducing fixing hardware. Accurate moulding techniques used in manufacture assure consistent heat spreader-to-heatsink capacitance.

ISOWATT220 thermal performance is better than that of the standard part, mounted with a 0.1mm mica washer. The thermally conductive plastic has a higher breakdown rating and is less fragile than mica or plastic sheets. Power derating for ISOWATT220 packages is determined by:

$$P_D = \frac{T_j - T_c}{R_{th}}$$

from this $I_{Dmax}$ for the POWER MOS can be calculated:

$$I_{Dmax} \leqslant \sqrt{\frac{P_D}{R_{DS(on) \text{ (at } 150°C)}}}$$

## THERMAL IMPEDANCE OF ISOWATT220 PACKAGE

Fig. 1 illustrates the elements contributing to the thermal resistance of transistor heatsink assembly, using ISOWATT220 package.

The total thermal resistance $R_{th \text{ (tot)}}$ is the sum of each of these elements.

The transient thermal impedance, $Z_{th}$ for different pulse durations can be estimated as follows:

1 - for a short duration power pulse less than 1ms;

$$Z_{th} < R_{thJ-C}$$

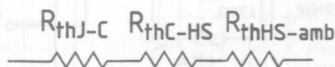2 - for an intermediate power pulse of 5ms to 50ms:

$$Z_{th} = R_{thJ-C}$$

3 - for long power pulses of the order of 500ms or greater:
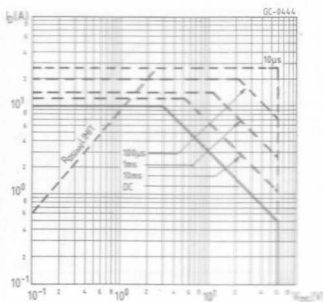
$$Z_{th} = R_{thJ-C} + R_{thC-HS} + R_{thHS-amb}$$

It is often possibile to discern these areas on transient thermal impedance curves.

Fig. 1
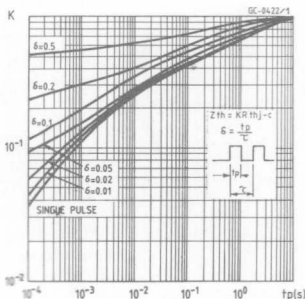


$$R_{thJ-C} \quad R_{thC-HS} \quad R_{thHS-amb}$$

## ISOWATT DATA

Safe operating areas



Thermal impedance



Derating curve

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