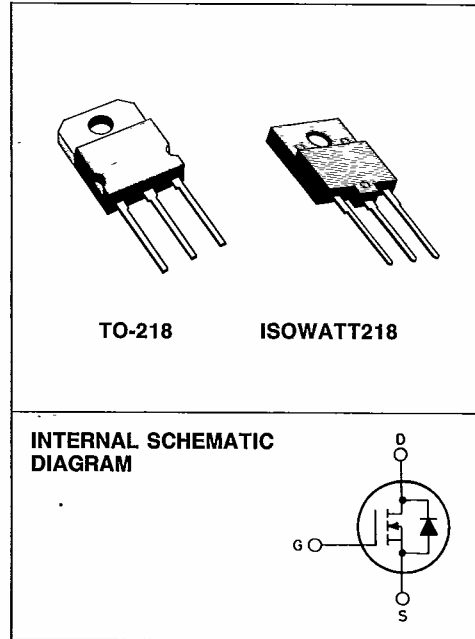


TYPE	V _{DSS}	R _{DS(on)}	I _D
MTH40N06	60 V	0.028 Ω	40 A
MTH40N06FI	60 V	0.028 Ω	26 A

- VERY LOW ON-LOSSES
- RATED FOR UNCLAMPED INDUCTIVE SWITCHING (ENERGY TEST) ♦
- LOW DRIVE ENERGY FOR EASY DRIVE
- HIGH TRANSCONDUCTANCE/C_{rss} RATIO

AUTOMOTIVE POWER APPLICATIONS

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


ABSOLUTE MAXIMUM RATINGS

		TO-218 ISOWATT218		MTH40N06 MTH40N06FI	
		TO-218	ISOWATT218	TO-218	ISOWATT218
V _{DS}	Drain-source voltage (V _{GS} = 0)			60	V
V _{DGR}	Drain-gate voltage (R _{GS} = 1 MΩ)			60	V
V _{GS}	Gate-source voltage			±20	V
I _{DM}	Drain current (pulsed)			140	A
I _D ■	Drain current (cont.) T _c = 20°C	40	26		A
P _{tot} ■	Total dissipation at T _c < 25°C	150	65		W
■	Derating factor	1.2	0.52		W/°C
T _{stg}	Storage temperature			-65 to 150	°C
T _J	Max. operating junction temperature			150	°C

■ See note on ISOWATT218 in this datasheet

♦ Introduced in 1988 week 44

THERMAL DATA

TO-218 ISOWATT218

$R_{th(j-c)}$	Thermal resistance junction-case	max	0.83	1.92	°C/W
T_l	Maximum lead temperature for soldering purpose	max	275		°C

ELECTRICAL CHARACTERISTICS ($T_{case} = 25^\circ\text{C}$ unless otherwise specified)

Parameters	Test Conditions	Min.	Typ.	Max.	Unit
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OFF

$V_{(BR)DSS}$	Drain-source breakdown voltage	$I_D = 100 \mu\text{A}$ $V_{GS} = 0$	60			V
I_{DSS}	Zero gate voltage drain current ($V_{GS} = 0$)	$V_{DS} = \text{Max Rating} \times 0.85$ $V_{DS} = \text{Max Rating} \times 0.85$ $T_c = 100^\circ\text{C}$			250 1000	μA μA
I_{GSS}	Gate-body leakage current ($V_{DS} = 0$)	$V_{GS} = \pm 20 \text{ V}$			± 100	nA

ON *

$V_{GS(th)}$	Gate threshold voltage	$V_{DS} = V_{GS}$ $I_D = 1 \text{ mA}$ $V_{DS} = V_{GS}$ $I_D = 1 \text{ mA}$ $T_c = 100^\circ\text{C}$	2 1.5		4.5 4	V V
$R_{DS(on)}$	Static drain-source on resistance	$V_{GS} = 10 \text{ V}$ $I_D = 20 \text{ A}$			0.028	Ω
$V_{DS(on)}$	Drain-source on voltage	$V_{GS} = 10 \text{ V}$ $I_D = 40 \text{ A}$ $V_{GS} = 10 \text{ V}$ $I_D = 20 \text{ A}$ $T_c = 100^\circ\text{C}$			1.4 1.12	V V

ENERGY TEST

I_{UIS}	Unclamped inductive switching current (single pulse)	$V_{DD} = 30 \text{ V}$ starting $T_j = 25^\circ\text{C}$	$L = 100 \mu\text{H}$	40			A
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DYNAMIC

g_{fs}^*	Forward transconductance	$V_{DS} = 15 \text{ V}$ $I_D = 20 \text{ A}$	10			mho
C_{iss}	Input capacitance	$V_{DS} = 25 \text{ V}$ $V_{GS} = 0$			5000	pF
C_{oss}	Output capacitance				2500	pF
C_{rss}	Reverse transfer capacitance				1000	pF
Q_g	Total gate charge	$V_{DS} = 50 \text{ V}$ $I_D = 40 \text{ A}$ $V_{GS} = 10 \text{ V}$			120	nC

ELECTRICAL CHARACTERISTICS (Continued)

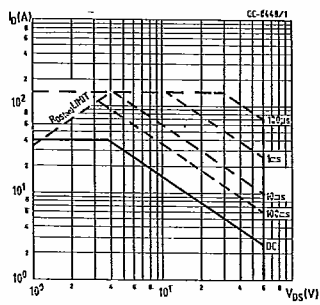
Parameters	Test Conditions	Min.	Typ.	Max.	Unit
T-39-11					
t_d (on)	Turn-on time	$V_{DD} = 25\text{ V}$	$I_D = 20\text{ A}$	50	ns
t_r	Rise time	$R_{gen} = 50\ \Omega$		300	ns
t_d (off)	Turn-off delay time			150	ns
t_f	Fall time			100	ns

SOURCE DRAIN DIODE

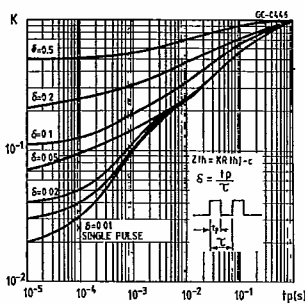
V_{SD}	Forward on voltage	$I_{SD} = 40\text{ A}$	$V_{GS} = 0$	3	V
t_{rr}	Reverse recovery time	$I_{SD} = 40\text{ A}$	$V_{GS} = 0$	200	ns
t_{on}	Forward turn-on time			150	ns

- * Pulsed: Pulse duration $\leq 300\ \mu\text{s}$, duty cycle $\leq 2\%$
- See note on ISOWATT218 in this datasheet

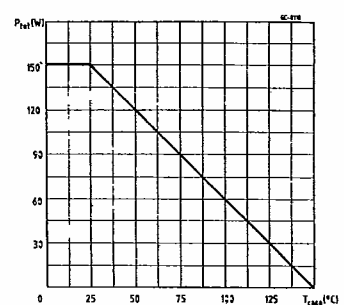
Safe operating areas
(standard package)



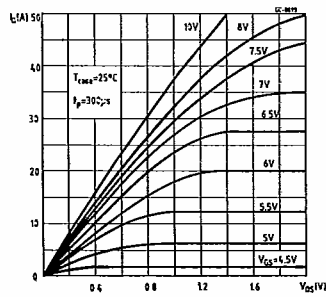
Thermal impedance
(standard package)



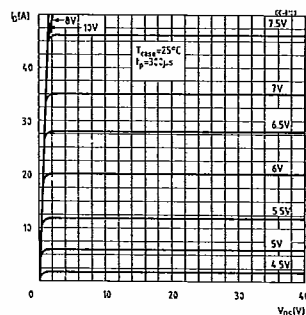
Derating curve
(standard package)



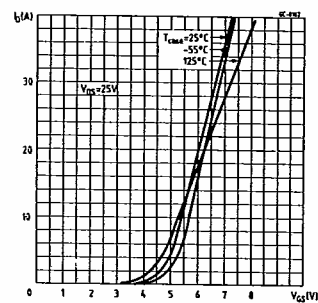
Output characteristics



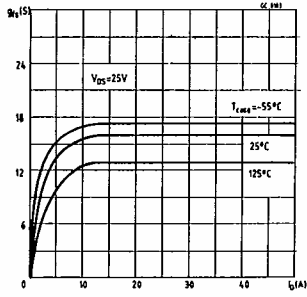
Output characteristics



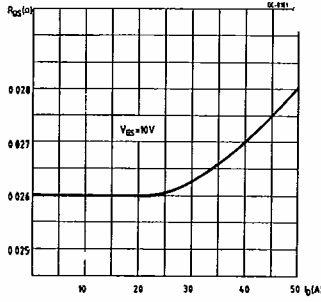
Transfer characteristics



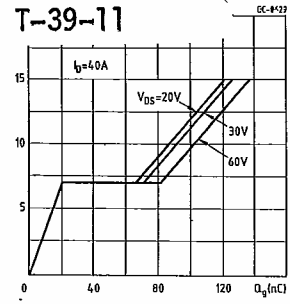
Transconductance



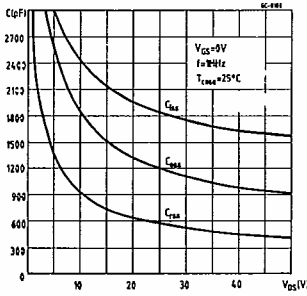
Static drain-source on resistance



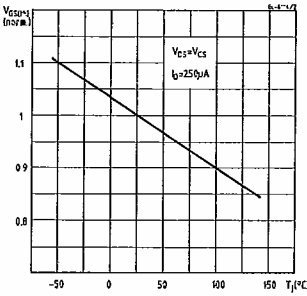
Gate charge vs gate-source voltage



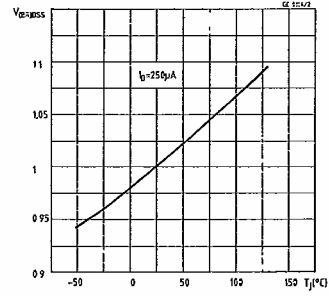
Capacitance variation



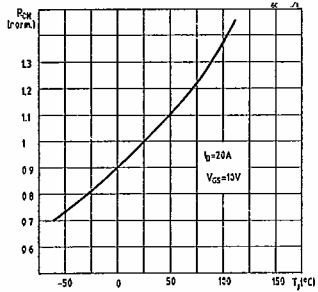
Normalized gate threshold voltage vs temperature



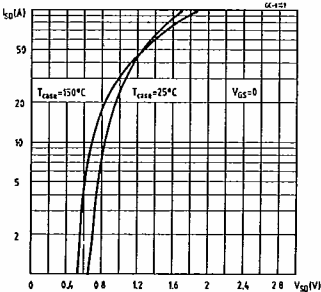
Normalized breakdown voltage vs temperature



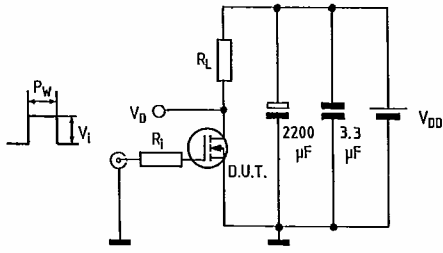
Normalized on resistance vs temperature



Source-drain diode forward characteristics



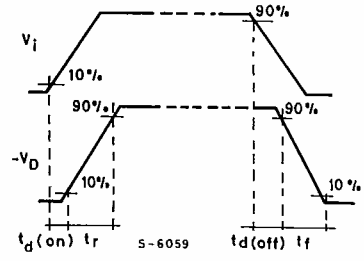
Switching times test circuit for resistive load



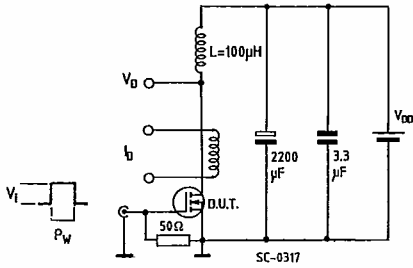
Pulse width $\leq 100 \mu s$
Duty cycle $\leq 2\%$

SC-0008/1

Switching time waveforms for resistive load



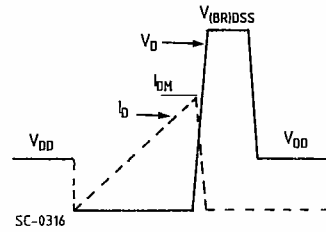
Unclamped inductive load test circuit



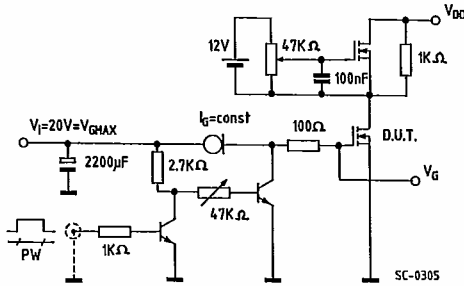
$V_i = 12 V$ - Pulse width: adjusted to obtain specified I_{DM}

SC-0317

Unclamped inductive waveforms



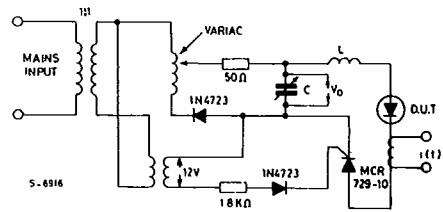
Gate charge test circuit



PW adjusted to obtain required V_G

SC-0305

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



ISOWATT218 PACKAGE CHARACTERISTICS AND APPLICATION.

ISOWATT218 is fully isolated to 4000V 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. These distances are in agreement with VDE and UL creepage and clearance standards. The ISOWATT218 package eliminates the need for external isolation so reducing fixing hardware.

The package is supplied with leads longer than the standard TO-218 to allow easy mounting on pcbs. Accurate moulding techniques used in manufacture assures consistent heat spreader-to-heatsink capacitance

ISOWATT218 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 ISOWATT218 packages is determined by:

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

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

$$I_{Dmax} \leq \sqrt{\frac{P_D}{R_{DS(on)} \text{ (at } 150^\circ\text{C)}}}$$

THERMAL IMPEDANCE OF ISOWATT218 PACKAGE

Fig. 1 illustrates the elements contributing to the thermal resistance of transistor heatsink assembly, using ISOWATT218 package.

The total thermal resistance $R_{th(tot)}$ 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:

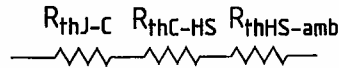
$$Z_{th} = R_{thJ-C}$$

3 - for long power pulses of the order of 500ms or greater:

$$Z_{th} = R_{thJ-C} + R_{thC-HS} + R_{thHS-amb}$$

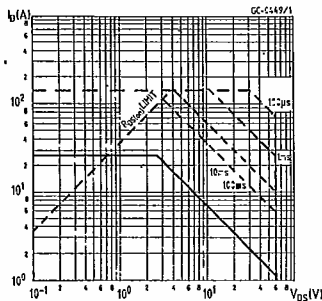
It is often possible to discern these areas on transient thermal impedance curves.

Fig. 1

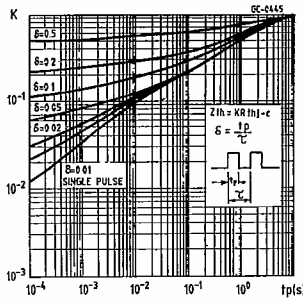


ISOWATT DATA

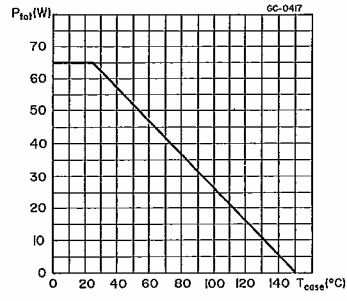
Safe operating areas



Thermal impedance



Derating curve



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