THERMAL FET HAF2002

Silicon N Channel MOS FET Series
Power Switching / Over Temperature Shut–down Capability

HITACHI

ADE-208-503
1st. Edition

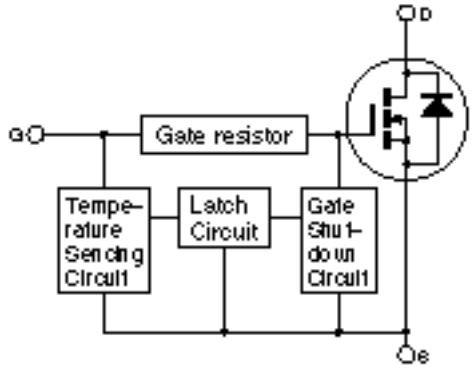
Features

This FET has the over temperature shut–down capability sensing to the junction temperature.
This FET has the built–in over temperature shut–down circuit in the gate area. And this circuit operation to shut–down the gate voltage in case of high junction temperature like applying over power consumption, over current etc.

- Logic level operation (4 to 6 V Gate drive)
- High endurance capability against to the short circuit
- Built–in the over temperature shut–down circuit
- Latch type shut–down operation (Need 0 voltage recovery)

Outline

TO–220FM



1. Gate
2. Drain
3. Source

Absolute Maximum Ratings (Ta = 25°C)

Item	Symbol	Ratings	Unit
Drain to source voltage	V_{DSS}	60	V
Gate to source voltage	V_{GSS+}	16	V
Gate to source voltage	V_{GSS-}	–2.8	V
Drain current	I_D	20	A
Drain peak current	$I_{D(pulse)}$ *[1]	40	A
Body to drain diode reverse drain current	I_{DR}	20	A
Channel dissipation	Pch *[2]	30	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

Notes: 1. PW ≤ 10µs, duty cycle ≤ 1 %
2. Value at Tc = 25°C

Typical Operation Characteristics

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Input voltage	V_{IH}	3.5	—	—	V	
	V_{IL}	—	—	1.2	V	
Input current	I_{IH1}	—	—	100	µA	Vi = 8V, V_{DS} = 0
(Gate non shut down)	I_{IH2}	—	—	50	µA	Vi = 3.5V, V_{DS} = 0
	I_{IL}	—	—	1	µA	Vi = 1.2V, V_{DS} = 0
Input current	$I_{IH(sd)1}$	—	0.8	—	mA	Vi = 8V, V_{DS} = 0
(Gate non shut down)	$I_{IH(sd)2}$	—	0.35	—	mA	Vi = 3.5V, V_{DS} = 0
Shut down temperature	T_{sd}	—	175	—	°C	Channel temperature

Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	10	—	—	A	V_{GS} = 3.5V, V_{DS} = 2V
Drain current	I_{D2}	—	—	10	mA	V_{GS} = 1.2V, V_{DS} = 2V
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	I_D = 10mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS+}$	16	—	—	V	I_G = 100µA, V_{DS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS–}$	–2.8	—	—	V	I_G = –100µA, V_{DS} = 0
Gate to source leak current	I_{GSS+1}	—	—	100	µA	V_{GS} = 8V, V_{DS} = 0
	I_{GSS+2}	—	—	50	µA	V_{GS} = 3.5V, V_{DS} = 0
	I_{GSS+3}	—	—	1	µA	V_{GS} = 1.2V, V_{DS} = 0
	$I_{GSS–}$	—	—	–100	µA	V_{GS} = –2.4V, V_{DS} = 0
Input current (shut down)	$I_{GS(op)1}$	—	0.8	—	mA	V_{GS} = 8V, V_{DS} = 0
	$I_{GS(op)1}$	—	0.35	—	mA	V_{GS} = 3.5V, V_{DS} = 0
Zero gate voltege drain current	I_{DSS}	—	—	250	µA	V_{DS} = 50 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.25	V	I_D = 1mA, V_{DS} = 10V
Static drain to source on state resistance	$R_{DS(on)}$	—	50	65	mΩ	ID = 10A, VGS = 4V *[1]
Static drain to source on state resistance	$R_{DS(on)}$	—	30	43	mΩ	I_D = 10A, V_{GS} = 10V*[1]
Forward transfer admittance	$\|y_{fs}\|$	6	12	—	S	I_D = 10A, V_{DS} = 10V*[1]
Output capacitance	Coss	—	630	—	pF	V_{DS} = 10V , V_{GS} = 0 f = 1 MHz
Turn-on delay time	$t_{d(on)}$	—	7.5	—	µs	I_D = 5A, V_{GS} = 5V
Rise time	t_r	—	29	—	µs	R_L = 6Ω
Turn-off delay time	$t_{d(off)}$	—	34	—	µs	
Fall time	t_f	—	26	—	µs	
Body to drain diode forward voltage	V_{DF}	—	1.0	—	V	I_F = 20A, V_{GS} = 0
Body to drain diode reverse recovery time	t_{rr}	—	110	—	ns	I_F = 20A, V_{GS} = 0 diF/ dt =50A/µs

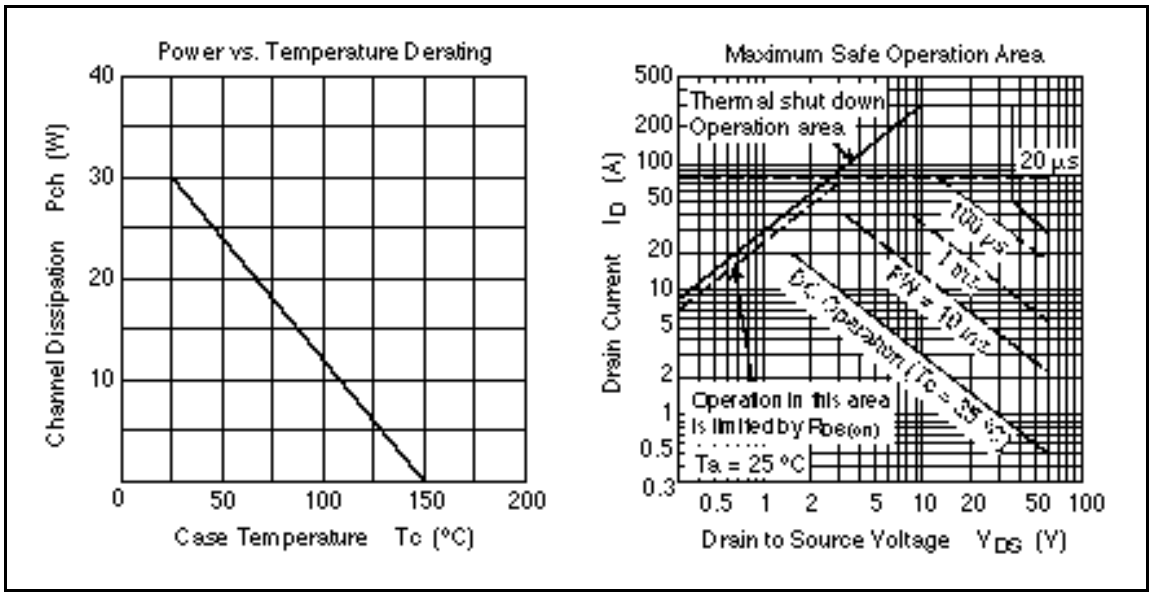
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Over load shut down	t_{os1}	—	1.8	—	ms	V_{GS} = 5V, V_{DD} = 12V
operation time *[2]	t_{os2}	—	0.7	—	ms	V_{GS} = 5V, V_{DD} = 24V

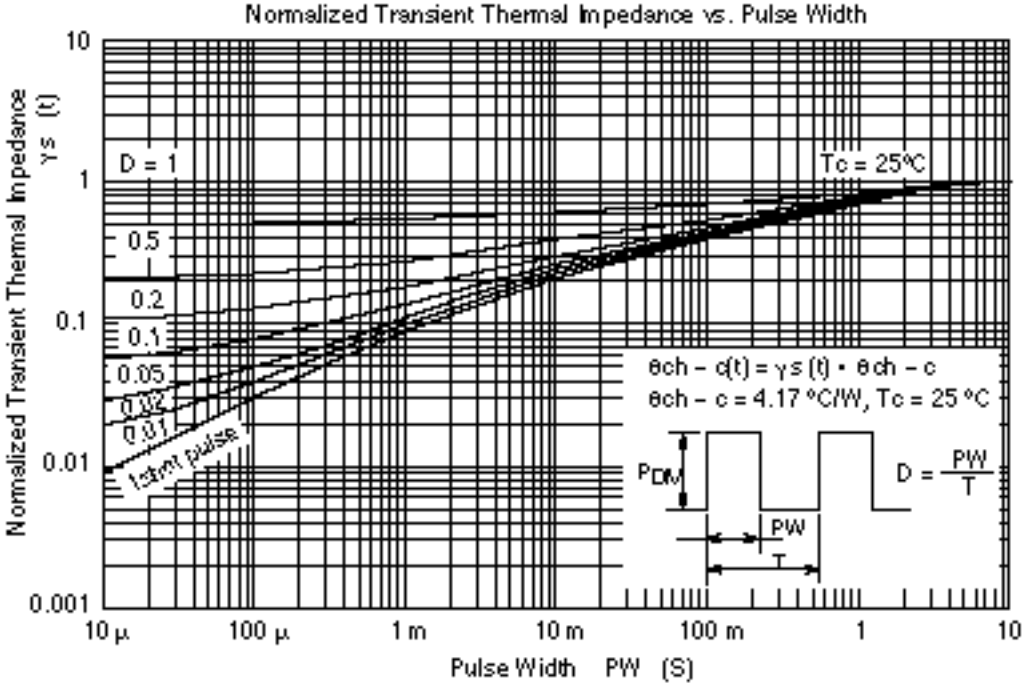
Notes: 1. Pulse test
2. Including the junction temperature raise of the over loaded condition.

• See characteristic curve of HAF2001.

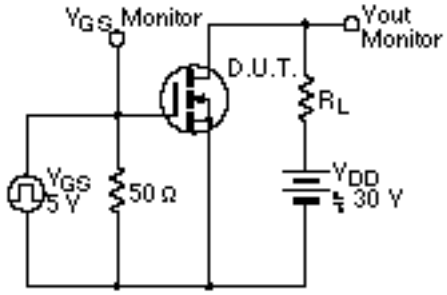
Main Characteristics



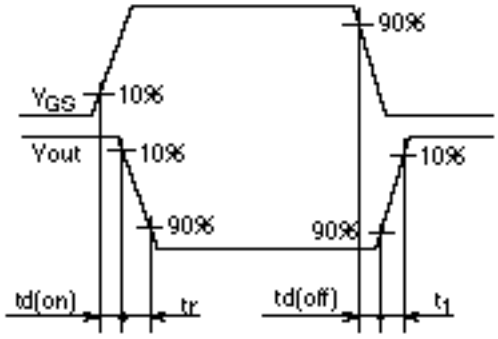
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit

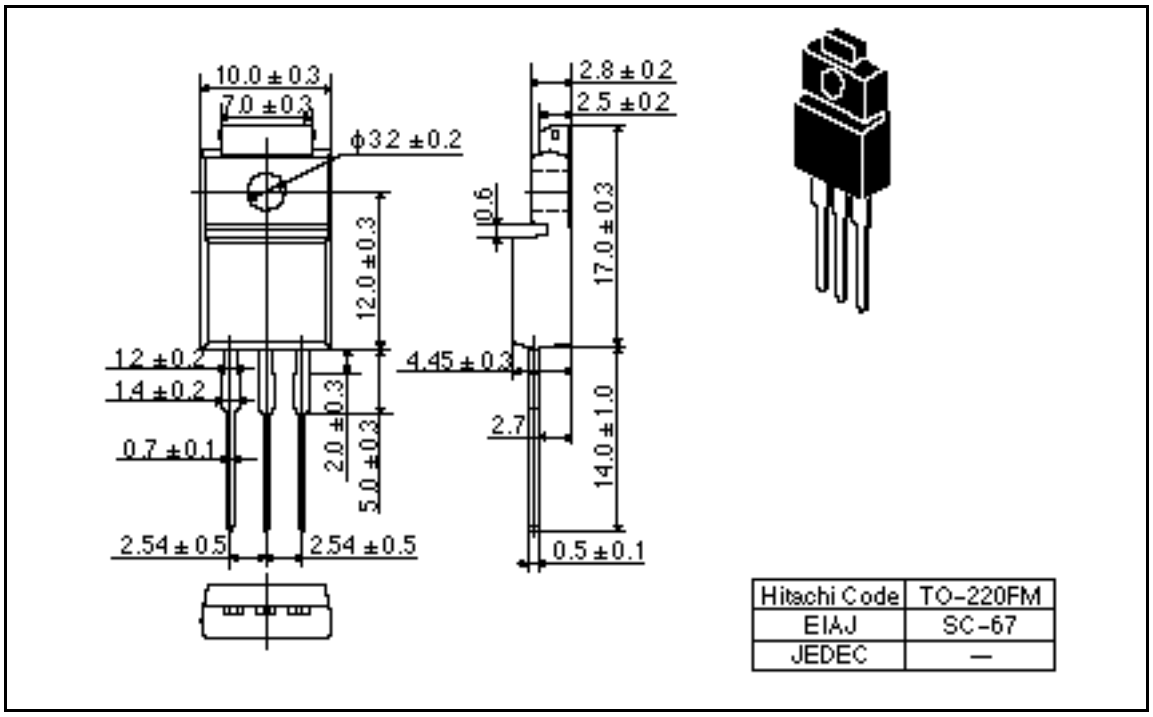


Waveform



Package Dimensions

Unit: mm



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