

HAF1001

Silicon P Channel MOS FET Series
Power Switching / Over Temperature Shut-down Capability

HITACHI

ADE-208-583 A (Z)

2nd Edition

October 1997

Features

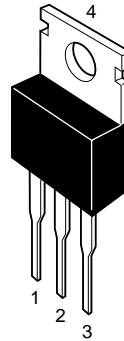
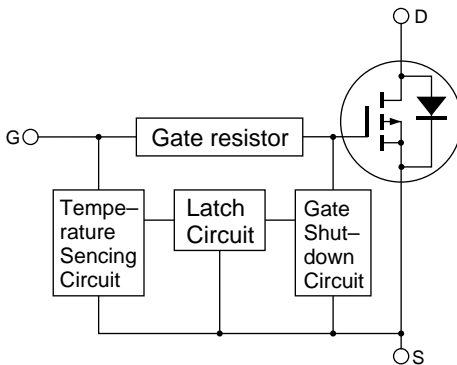
This FET has the over temperature shut-down capability sensing to the junction temperature.

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-220AB



1. Gate
2. Drain
3. Source
4. Drain

Absolute Maximum Ratings ($T_a = 25^\circ\text{C}$)

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-}	3	V
Drain current	I_D	-15	A
Drain peak current	$I_{D(pulse)}$ ^{Note1}	-30	A
Body-drain diode reverse drain current	I_{DR}	-15	A
Channel dissipation	P_{ch} ^{Note2}	50	W
Channel temperature	T_{ch}	150	$^\circ\text{C}$
Storage temperature	T_{stg}	-55 to +150	$^\circ\text{C}$

Note: 1. $PW \leq 10\mu\text{s}$, duty cycle $\leq 1\%$
 2. Value at $T_c = 25^\circ\text{C}$

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	$V_i = -8\text{V}$, $V_{DS} = 0$
(Gate non shut down)	I_{IH2}	—	—	-50	μA	$V_i = -3.5\text{V}$, $V_{DS} = 0$
	I_{IL}	—	—	-1	μA	$V_i = -1.2\text{V}$, $V_{DS} = 0$
Input current	$I_{IH(sd)1}$	—	-0.8	—	mA	$V_i = -8\text{V}$, $V_{DS} = 0$
(Gate shut down)	$I_{IH(sd)2}$	—	-0.35	—	mA	$V_i = -3.5\text{V}$, $V_{DS} = 0$
Shut down temperature	T_{sd}	—	175	—	$^\circ\text{C}$	Channel temperature
Gate operation voltage	V_{OP}	-3.5	—	-13	V	

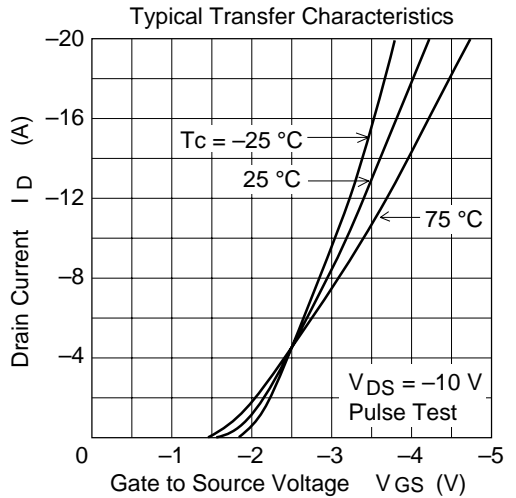
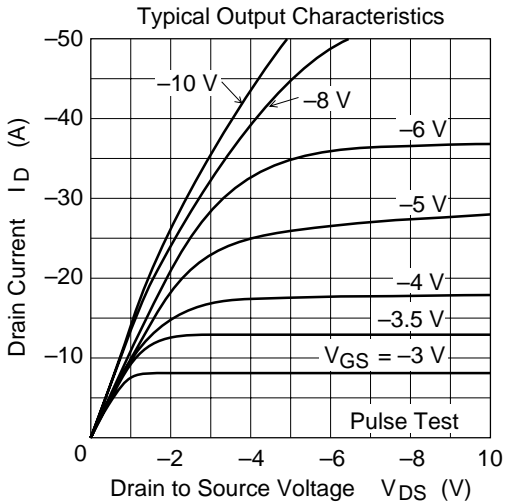
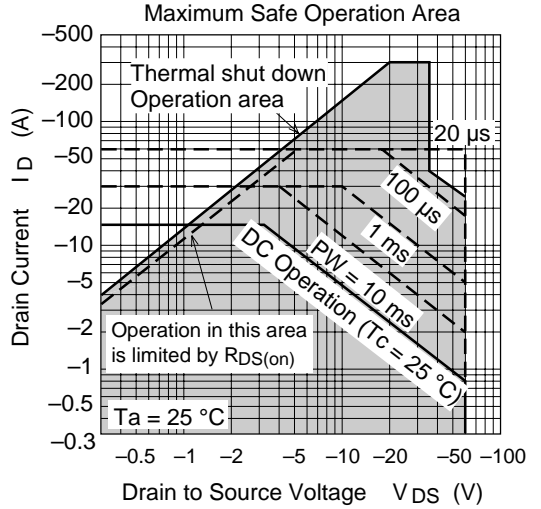
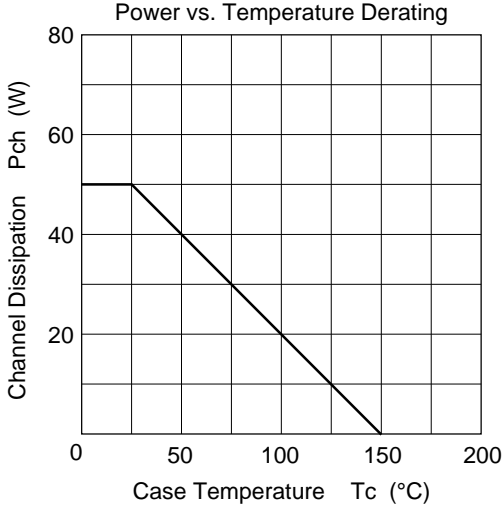
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	-7	—	—	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	$I_G = -100\mu A, V_{DS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS-}$	3	—	—	V	$I_G = 100\mu A, V_{DS} = 0$
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 voltage drain current	I_{DSS}	—	—	-250	μA	$V_{DS} = -50V, V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	-1.1	—	-2.25	V	$I_D = -1mA, V_{DS} = -10V$
Static drain to source on state resistance	$R_{DS(on)}$	—	100	130	m Ω	$I_D = -7.5A, V_{GS} = -4V$ ^{Note3}
Static drain to source on state resistance	$R_{DS(on)}$	—	70	90	m Ω	$I_D = -7.5A$ $V_{GS} = -10V$ ^{Note3}
Forward transfer admittance	$ y_{fs} $	5	10	—	S	$I_D = -7.5A, V_{DS} = -10V$ ^{Note3}
Output capacitance	C_{oss}	—	610	—	pF	$V_{DS} = -10V, V_{GS} = 0$ $f = 1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	7.5	—	μs	$I_D = -7.5A, V_{GS} = -5V$
Rise time	t_r	—	36	—	μs	$R_L = 4\Omega$
Turn-off delay time	$t_{d(off)}$	—	32	—	μs	
Fall time	t_f	—	29	—	μs	
Body-drain diode forward voltage	V_{DF}	—	-1.0	—	V	$I_F = -15A, V_{GS} = 0$
Body-drain diode reverse recovery time	t_{rr}	—	200	—	ns	$I_F = -15A, V_{GS} = 0$ $diF/dt = 50A/\mu s$
Over load shut down operation time	t_{os1}	—	3.7	—	ms	$V_{GS} = -5V, V_{DD} = -12V$
	t_{os2}	—	1	—	ms	$V_{GS} = -5V, V_{DD} = -24V$

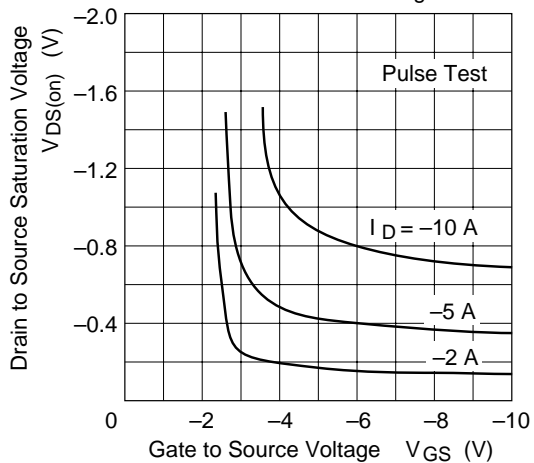
Note: 3. Pulse test

4. Including the junction temperature rise of the over loaded condition.

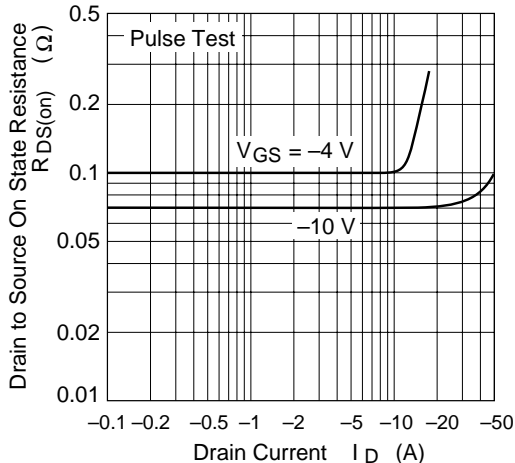
Main Characteristics



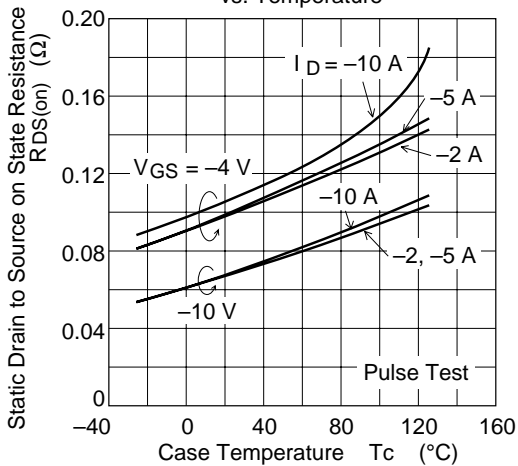
Drain to Source Saturation Voltage vs. Gate to Source Voltage



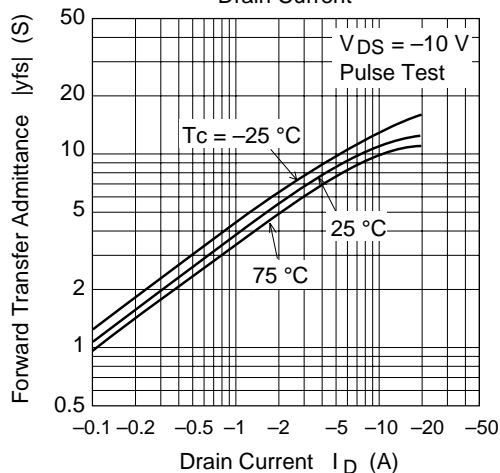
Static Drain to Source State Resistance vs. Drain Current

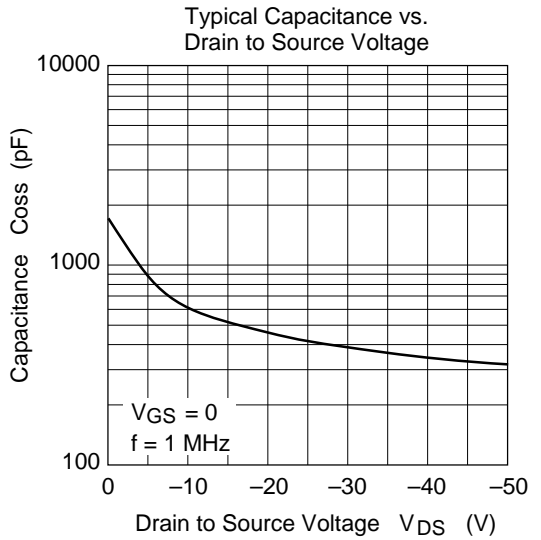
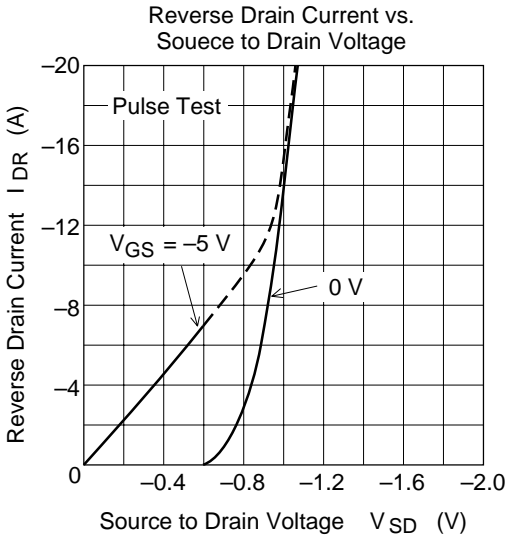
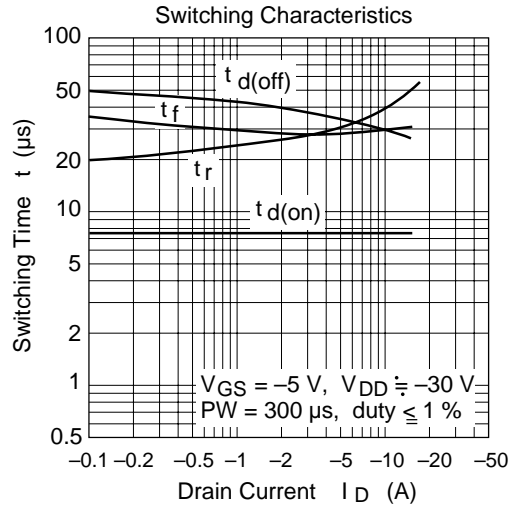
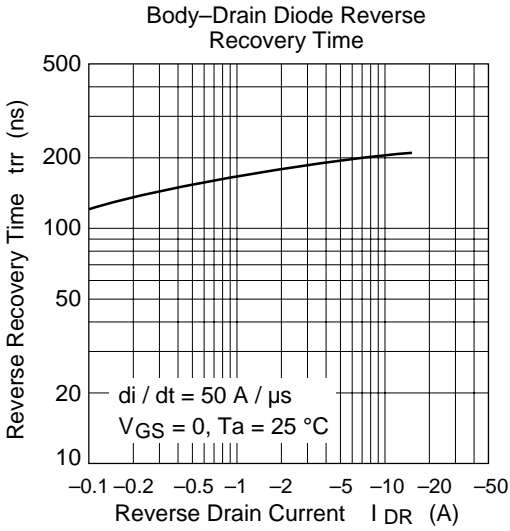


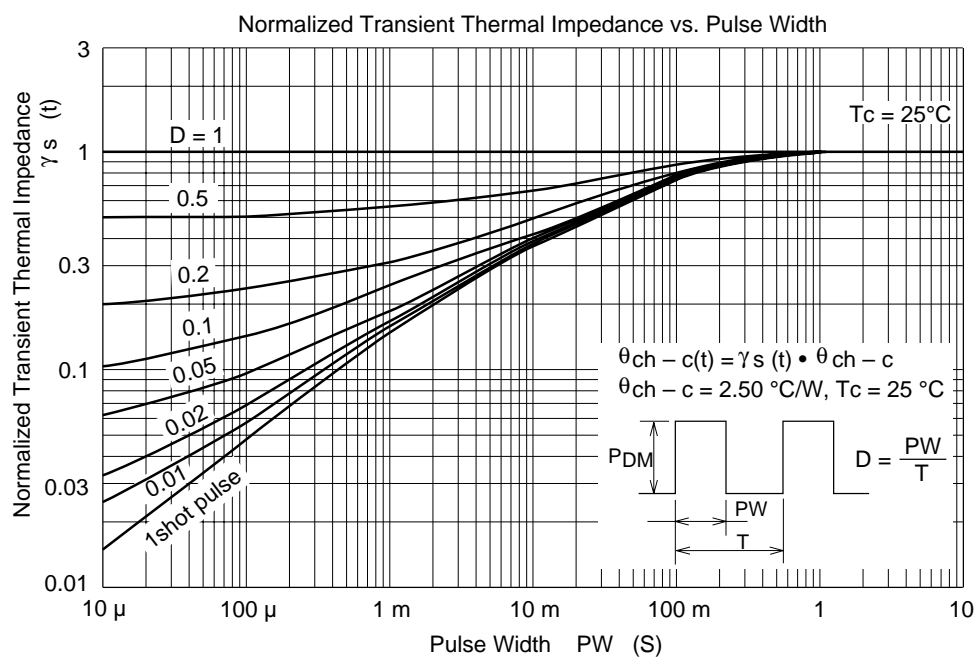
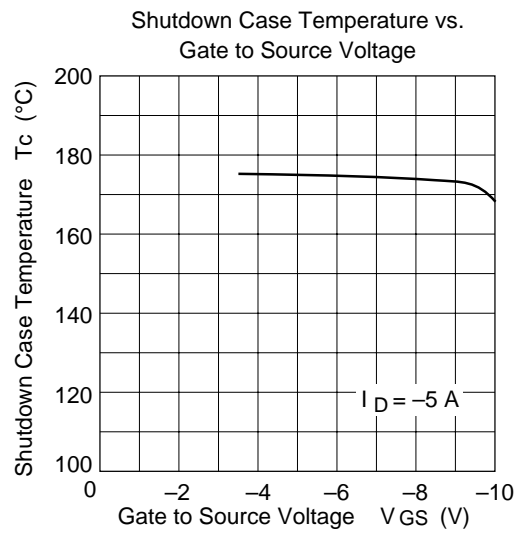
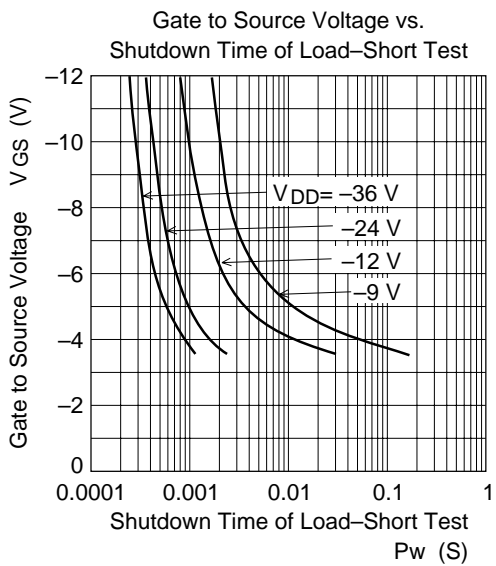
Static Drain to Source on State Resistance vs. Temperature



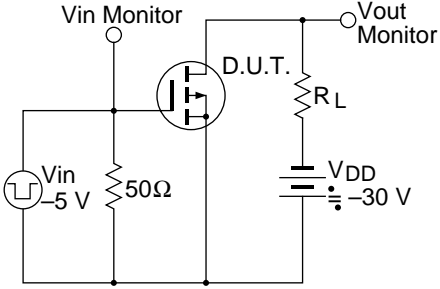
Forward Transfer Admittance vs. Drain Current



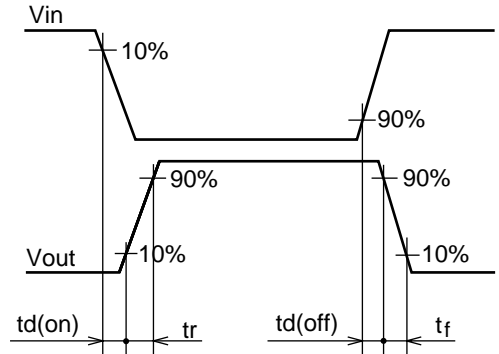




Switching Time Test Circuit

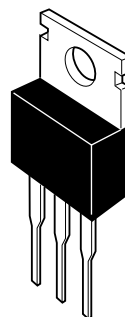
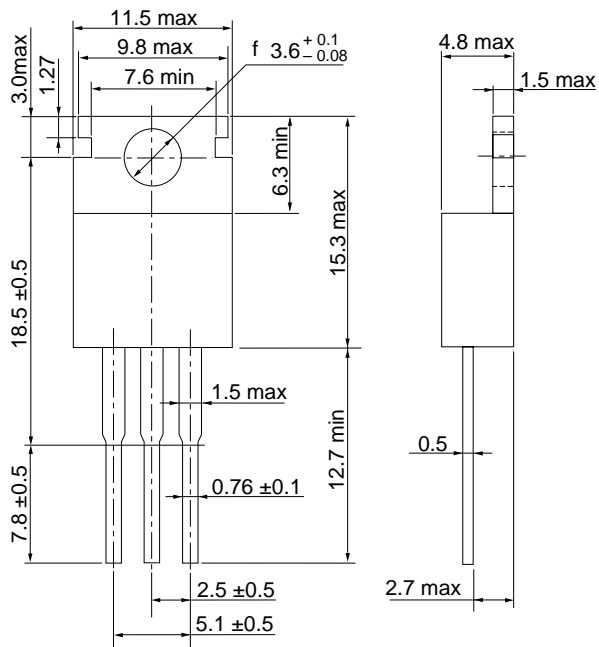


Waveform



Package Dimensions

Unit: mm



Hitachi Code	TO-220AB
EIAJ	SC-46
JEDEC	—

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