

HAF1001

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

HITACHI

ADE-208-583 A (Z)
2nd Edition
October 1997

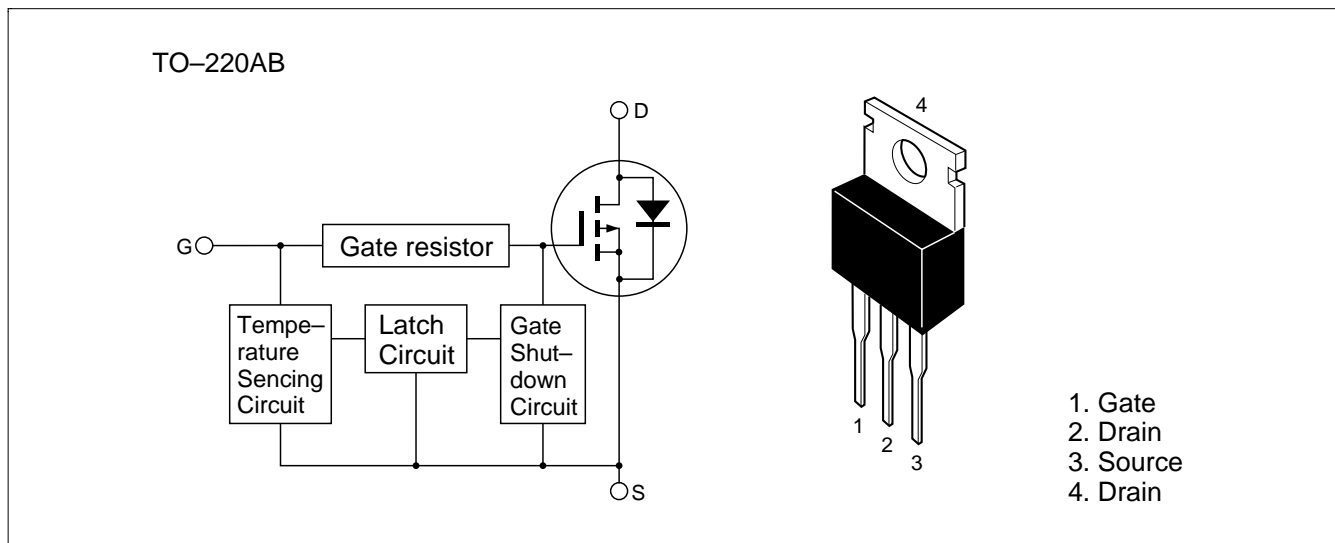
Features

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



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-}	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	Pch ^{Note2}	50	W
Channel temperature	Tch	150	°C
Storage temperature	$Tstg$	-55 to +150	°C

Note: 1. $PW \leq 10\mu s$, duty cycle $\leq 1\%$

2. Value at $Tc = 25^\circ C$

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 (Gate non shut down)	I_{IH1}	—	—	-100	μA	$V_i = -8V, V_{DS} = 0$
	I_{IH2}	—	—	-50	μA	$V_i = -3.5V, V_{DS} = 0$
	I_{IL}	—	—	-1	μA	$V_i = -1.2V, V_{DS} = 0$
Input current (Gate shut down)	$I_{IH(sd)1}$	—	-0.8	—	mA	$V_i = -8V, V_{DS} = 0$
	$I_{IH(sd)2}$	—	-0.35	—	mA	$V_i = -3.5V, V_{DS} = 0$
Shut down temperature	T_{sd}	—	175	—	°C	Channel temperature
Gate operation voltage	V_{OP}	-3.5	—	-13	V	

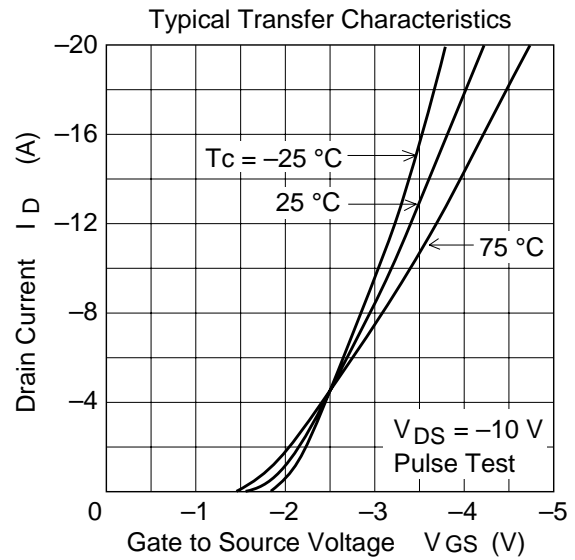
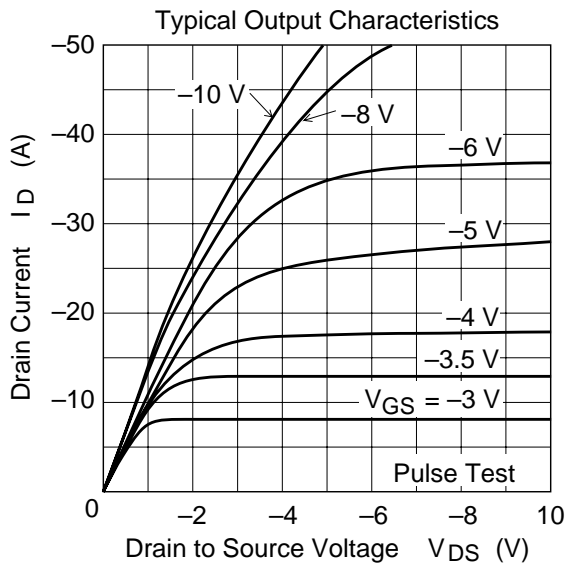
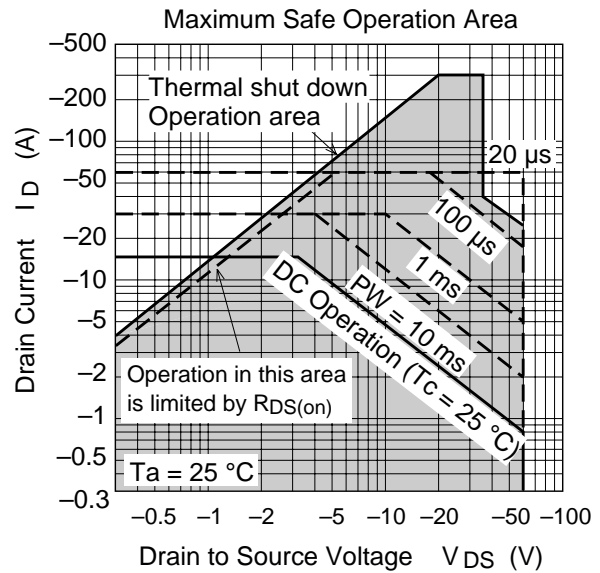
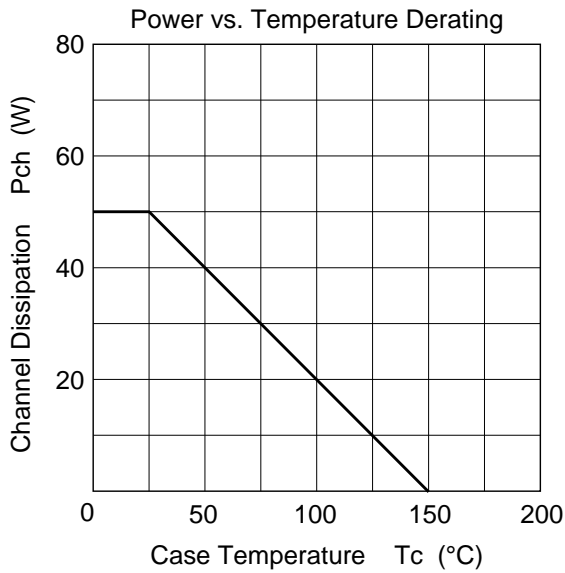
Electrical Characteristics (Ta = 25°C)

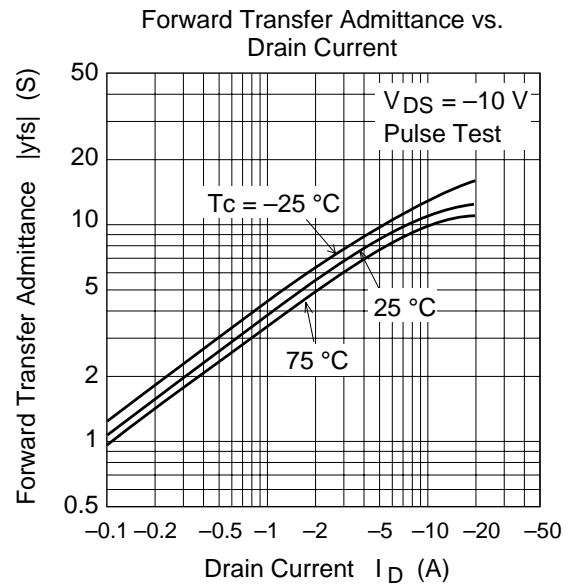
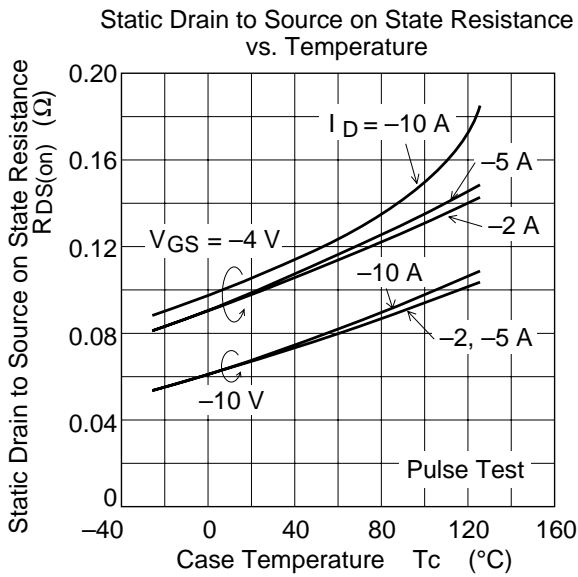
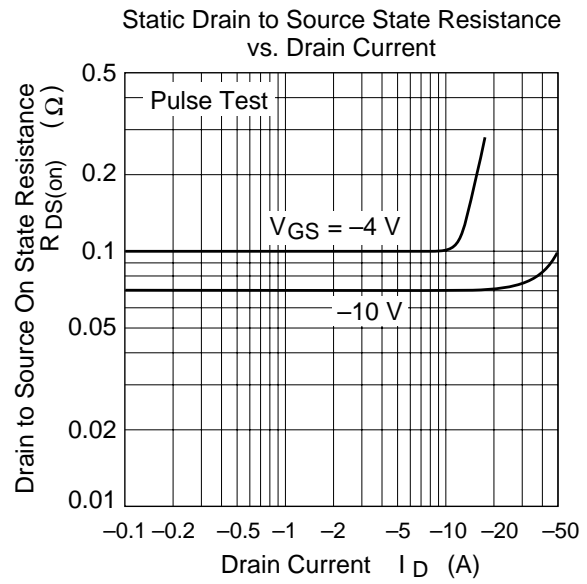
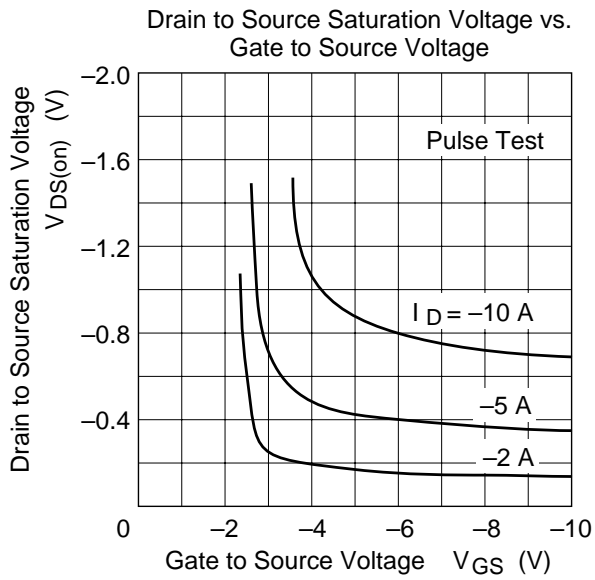
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	-7	—	—	A	$V_{GS} = -3.5V, V_{DS} = -2V$
Drain current	I_{D2}	—	—	-10	mA	$V_{GS} = -1.2V, V_{DS} = -2V$
Drain to source breakdown voltage	$V_{(BR)DSS}$	-60	—	—	V	$I_D = -10mA, V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS+}$	-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 ^{Note4}	t_{os1}	—	3.7	—	ms	$V_{GS} = -5V, V_{DD} = -12V$
	t_{os2}	—	1	—	ms	$V_{GS} = -5V, V_{DD} = -24V$

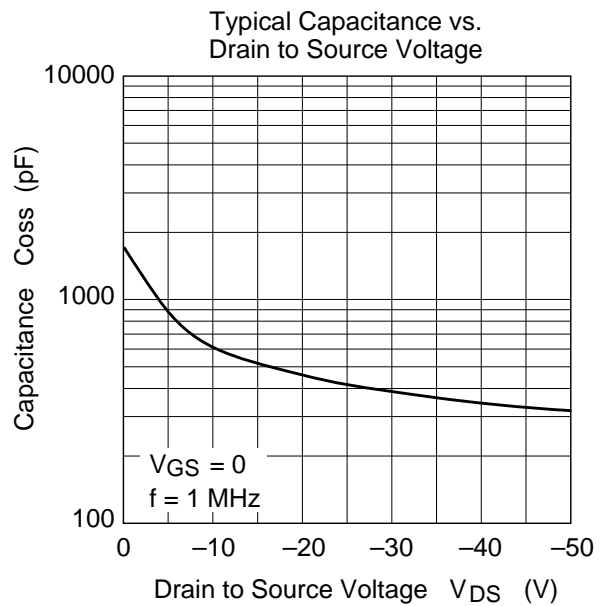
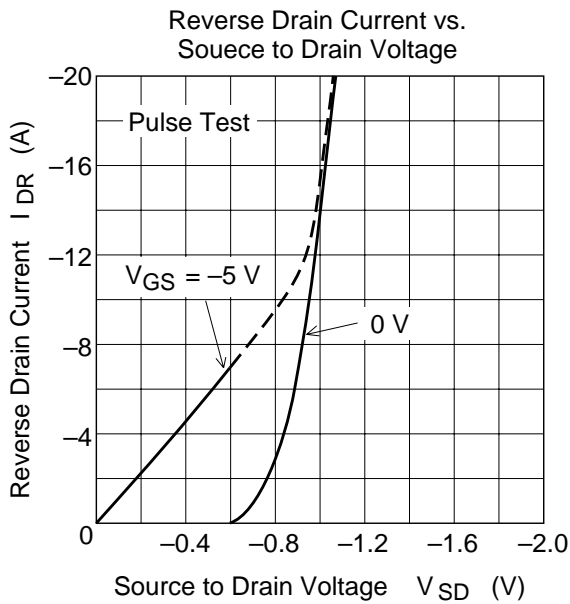
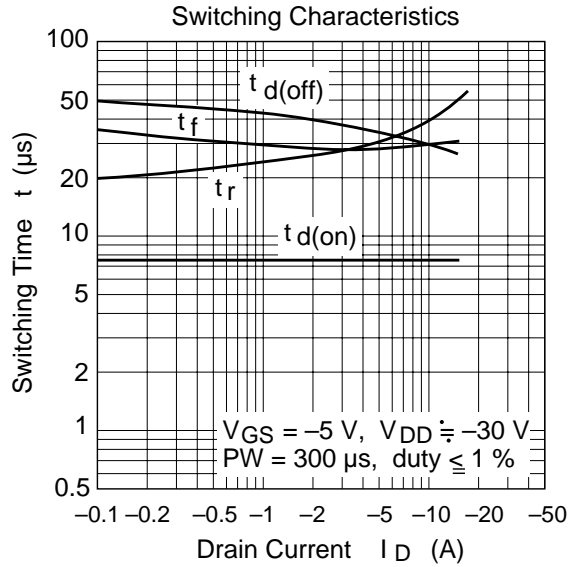
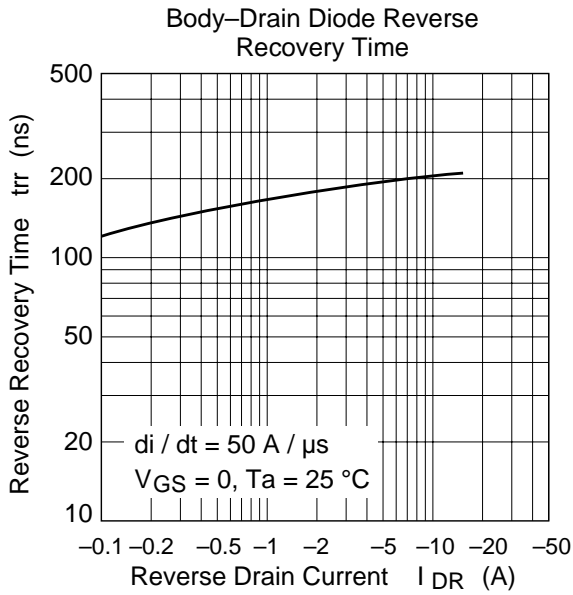
Note: 3. Pulse test

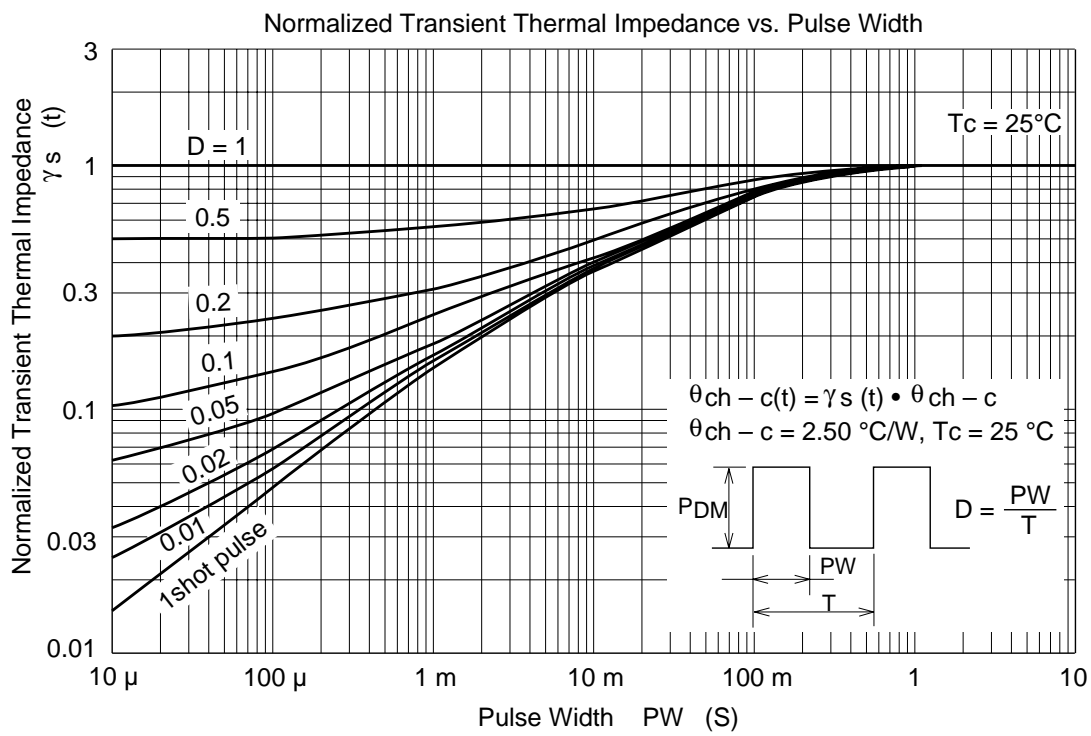
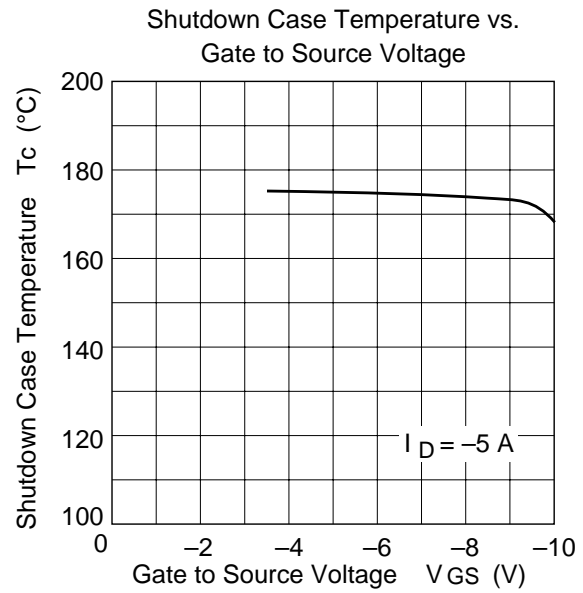
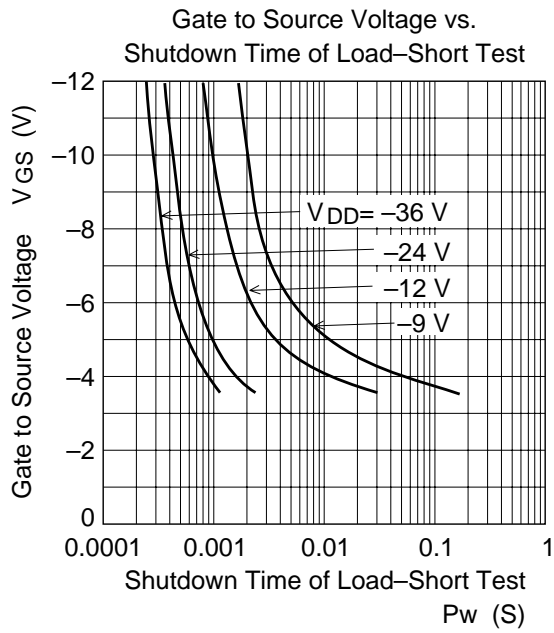
4. Including the junction temperature rise of the over loaded condition.

Main Characteristics

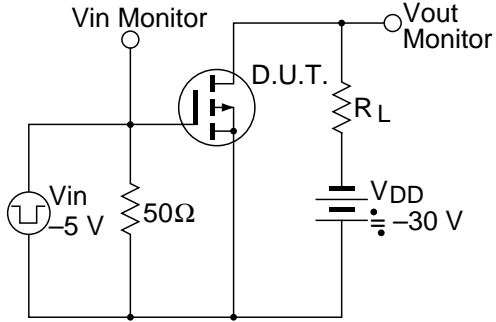




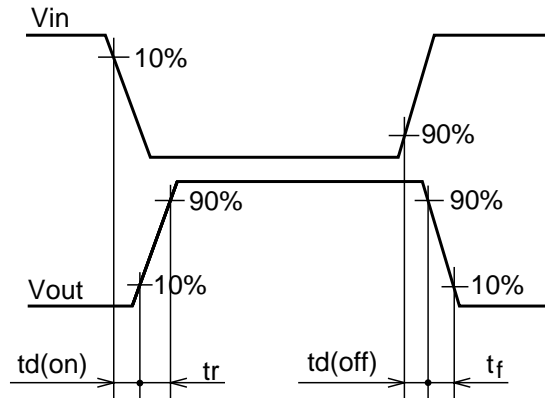




Switching Time Test Circuit

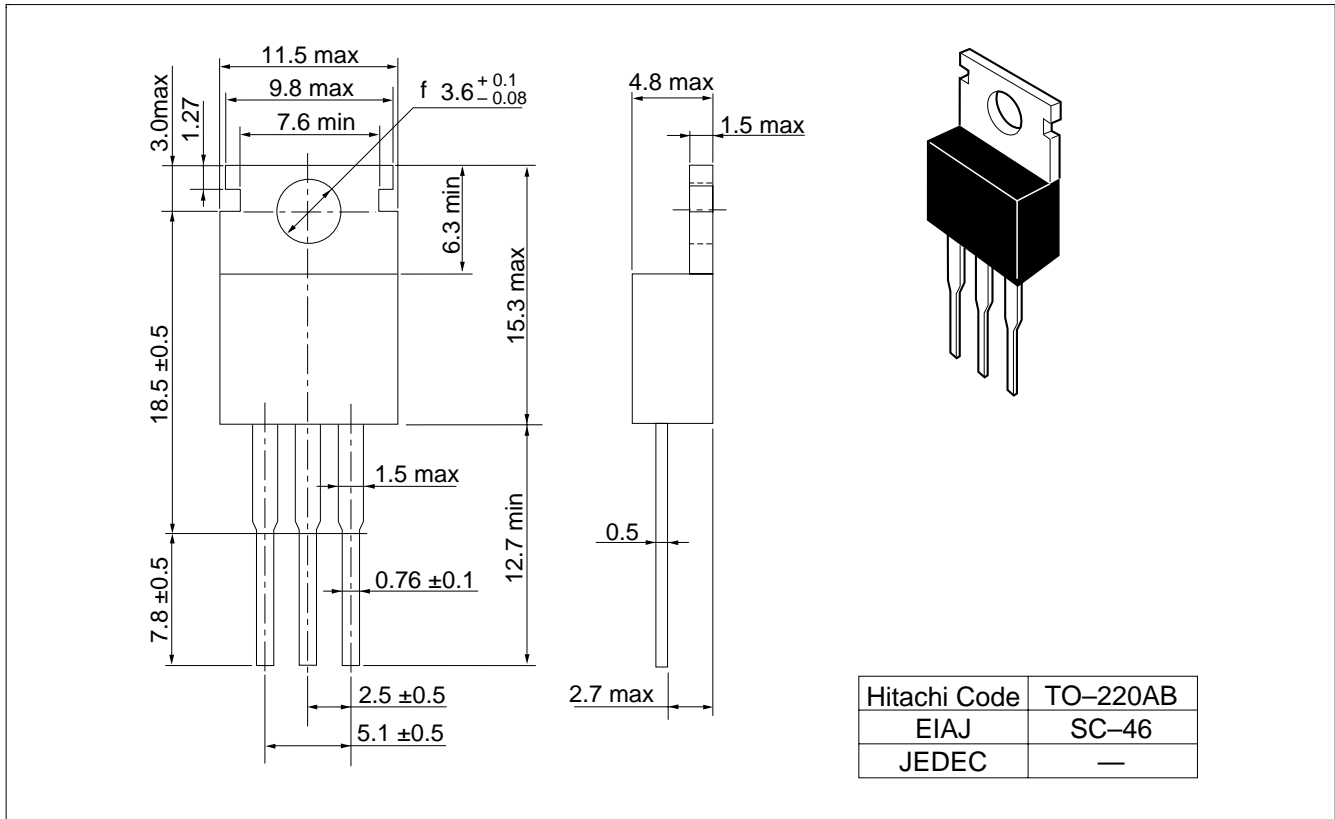


Waveform



Package Dimensions

Unit: mm



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