

HAF1003(L), HAF1003(S)

Silicon P Channel MOS FET Series
Power Switching

HITACHI

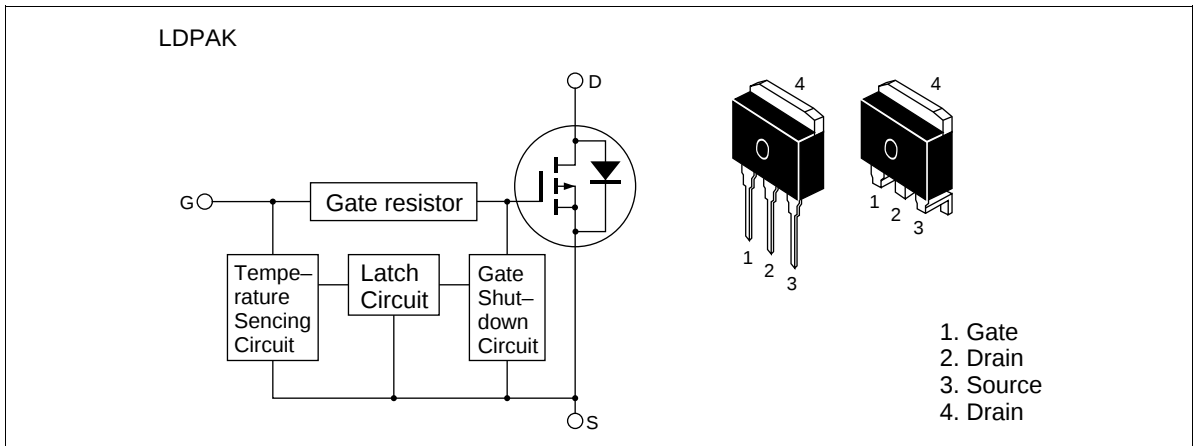
ADE-208-626B (Z)
3rd. Edition
July 2000

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.

Features

- 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



HAF1003(L), HAF1003(S)

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}	2.5	V
Drain current	I_D	−18	A
Drain peak current	$I_{D(pulse)}$ ^{Note1}	−36	A
Body-drain diode reverse drain current	I_{DR}	−18	A
Channel dissipation	P_{ch} ^{Note2}	50	W
Channel temperature	T_{ch}	150	°C
Storage temperature	T_{stg}	−55 to +150	°C

Note: 1. $PW \leq 10ms$, duty cycle $\leq 1\%$
2. Value at $T_c = 25^\circ C$

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	—	−12	V	

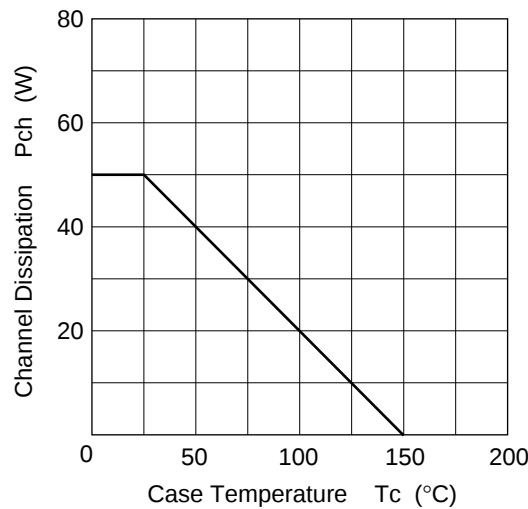
Electrical Characteristics (Ta = 25°C)

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain current	I_{D1}	-6	—	—	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	$I_G = -300\mu A, V_{DS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	2.5	—	—	V	$I_G = 100\mu A, V_{DS} = 0$
Gate to source leak current	I_{GSS1}	—	—	-100	μA	$V_{GS} = -8V, V_{DS} = 0$
	I_{GSS2}	—	—	-50	μA	$V_{GS} = -3.5V, V_{DS} = 0$
	I_{GSS3}	—	—	-1	μA	$V_{GS} = -1.2V, V_{DS} = 0$
	I_{GSS4}	—	—	100	μA	$V_{GS} = 2.4V, V_{DS} = 0$
Input current (shut down)	$I_{GS(op)1}$	—	-0.8	—	mA	$V_{GS} = -8V, V_{DS} = 0$
	$I_{GS(op)2}$	—	-0.35	—	mA	$V_{GS} = -3.5V, V_{DS} = 0$
Zero gate voltage drain current	I_{DSS}	—	—	-10	μA	$V_{DS} = -60V, V_{GS} = 0$
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	$R_{DS(on)}$	—	80	110	m Ω	$I_D = -9A, V_{GS} = -4V$ ^{Note3}
Static drain to source on state resistance	$R_{DS(on)}$	—	52	60	m Ω	$I_D = -9A, V_{GS} = -10V$ ^{Note3}
Forward transfer admittance	$ y_{fs} $	5.3	11	—	S	$I_D = -9A, V_{DS} = -10V$ ^{Note3}
Output capacitance	C_{oss}	—	700	—	pF	$V_{DS} = -10V, V_{GS} = 0$ $f = 1\text{ MHz}$
Turn-on delay time	$t_{d(on)}$	—	8.7	—	μs	$I_D = -9A, V_{GS} = -5V$
Rise time	t_r	—	44.5	—	μs	$R_L = 3.3\Omega$
Turn-off delay time	$t_{d(off)}$	—	4	—	μs	
Fall time	t_f	—	4.6	—	μs	
Body-drain diode forward voltage	V_{DF}	—	-0.9	—	V	$I_F = -18A, V_{GS} = 0$
Body-drain diode reverse recovery time	t_{rr}	—	140	—	ns	$I_F = -18A, V_{GS} = 0$ $diF/dt = 50A/\mu s$
Over load shut down	t_{os1}	—	3	—	ms	$V_{GS} = -5V, V_{DD} = -16V$
operation time ^{Note4}	t_{os2}	—	1.5	—	ms	$V_{GS} = -5V, V_{DD} = -24V$

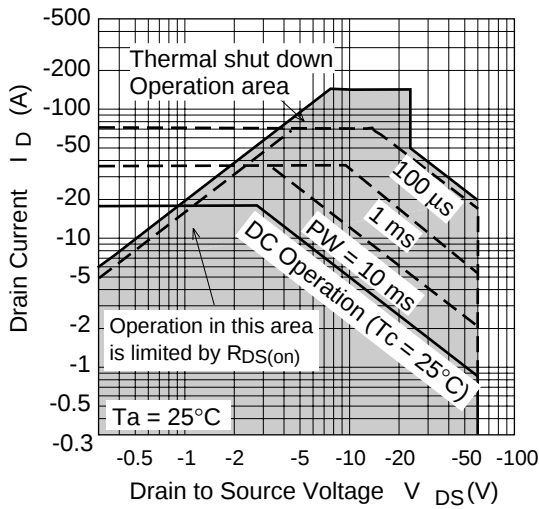
Note: 3. Pulse test

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

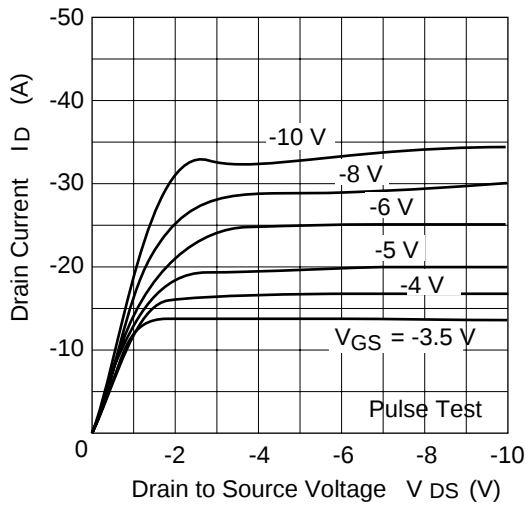
Power vs. Temperature Derating



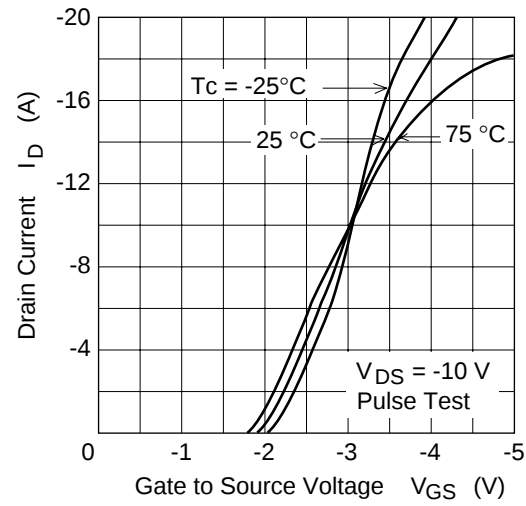
Maximum Safe Operation Area



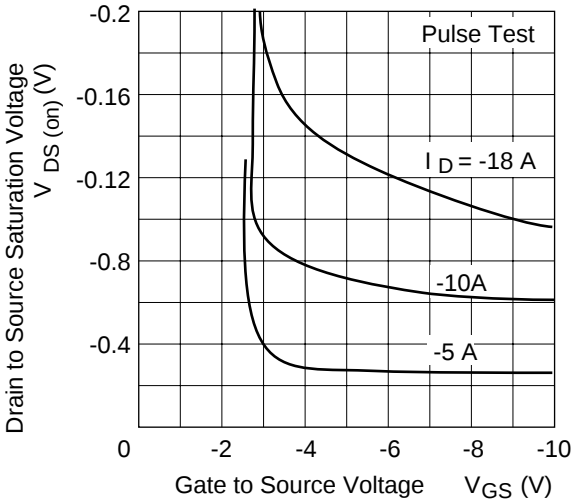
Typical Output Characteristics



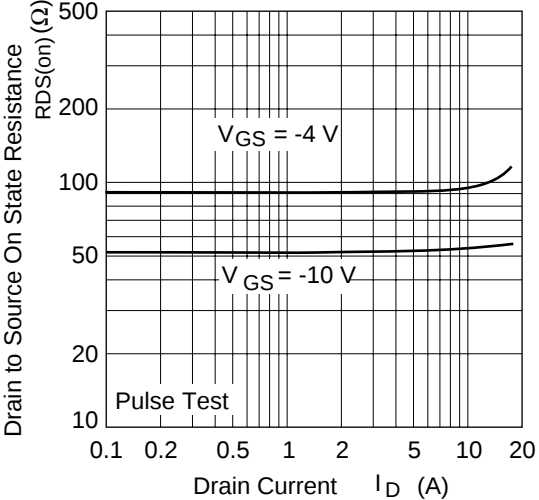
Typical Transfer Characteristics



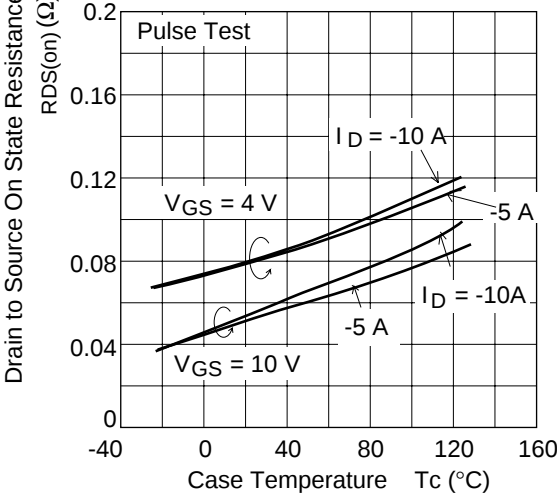
Drain to Source Saturation Voltage vs.
Gate to Source Voltage



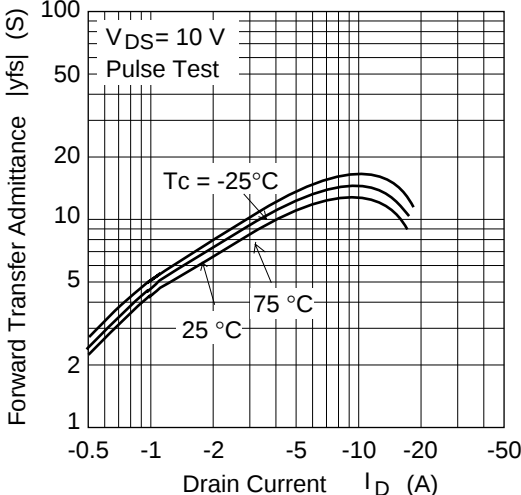
Static Drain to Source State Resistance
vs. Drain Current

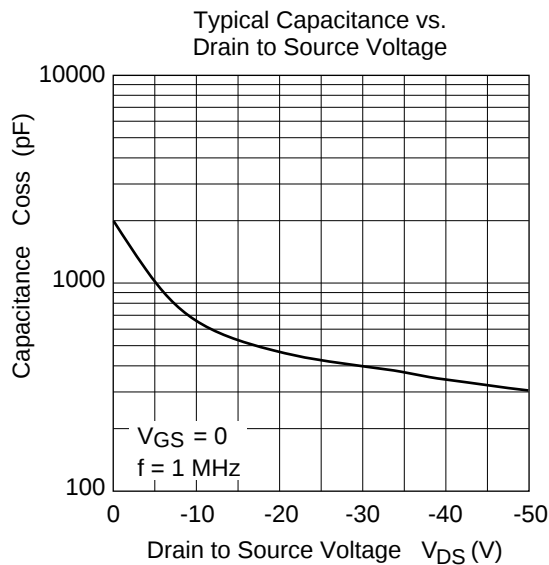
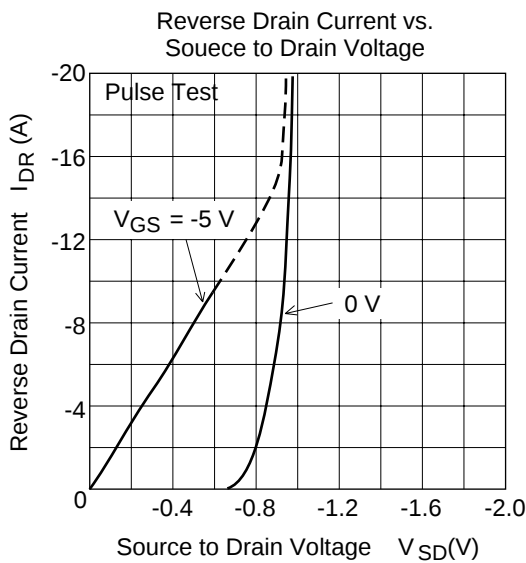
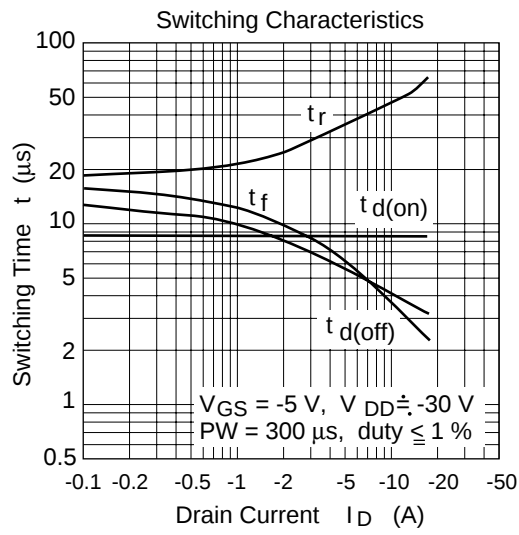
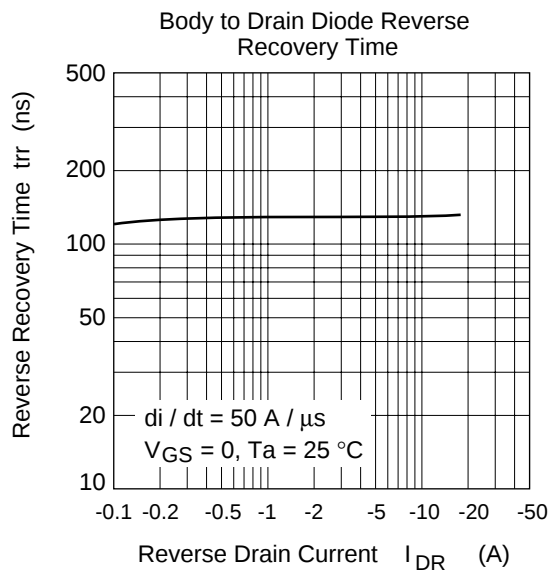


Static Drain to Source on state Resistance
vs. Temperature

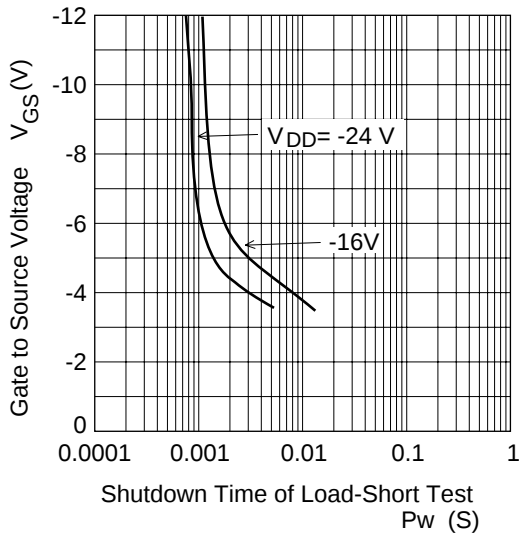


Forward Transfer Admittance vs.
Drain Current

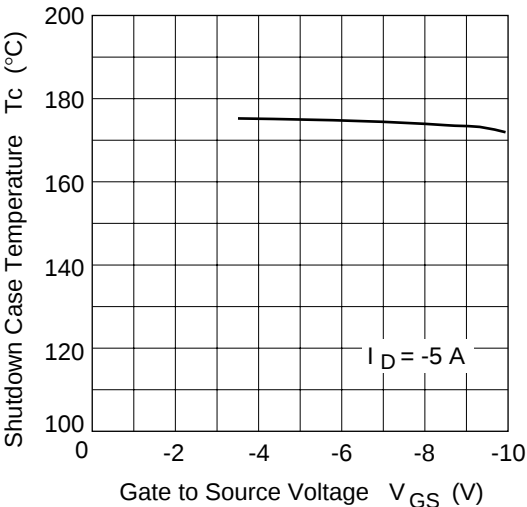




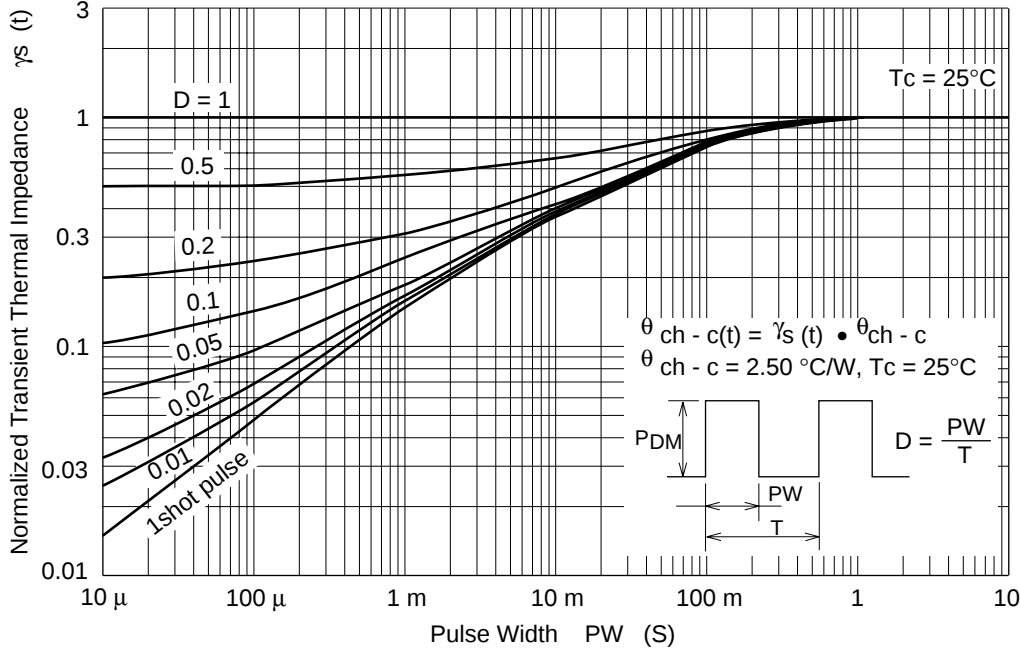
Gate to Source Voltage vs.
Shutdown Time of Load-Short Test



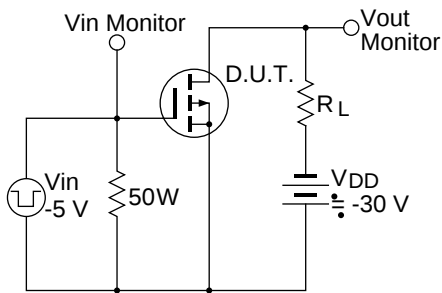
Shutdown Case Temperature vs.
Gate to Source Voltage



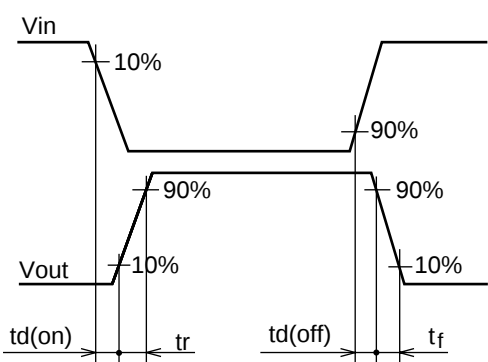
Normalized Transient Thermal impedance vs. Pulse Width



Switching Time Test Circuit

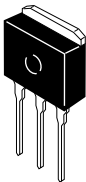
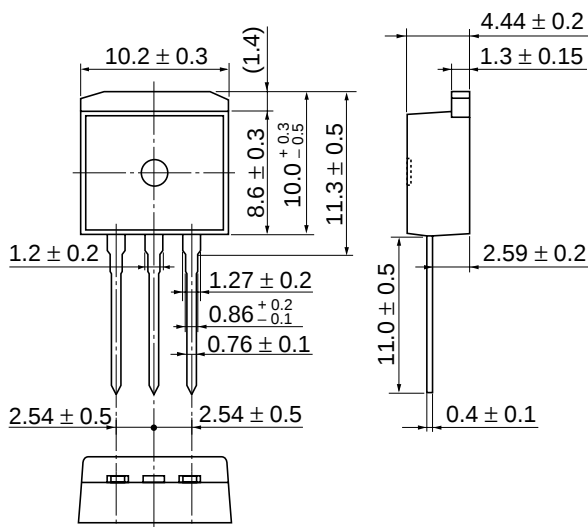


Waveform



Package Dimensions

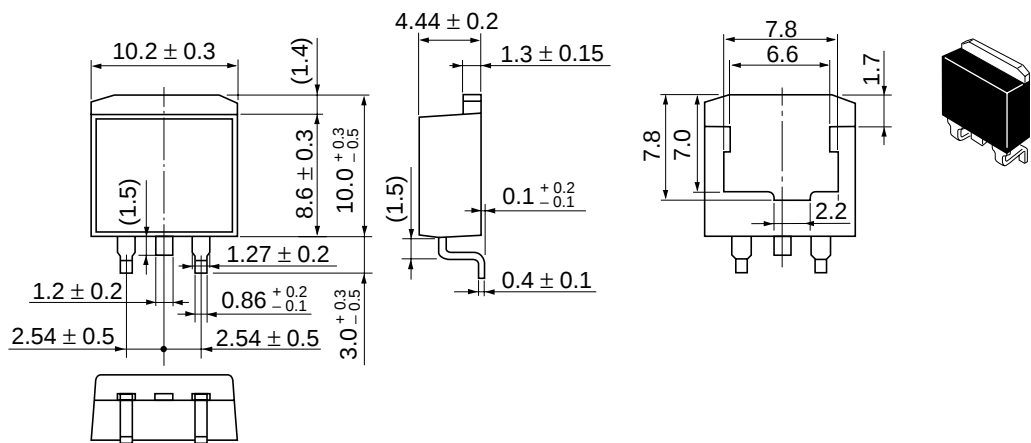
As of January, 2001
Unit: mm



Hitachi Code	LDPAK (L)
JEDEC	—
EIAJ	—
Mass (reference value)	1.4 g

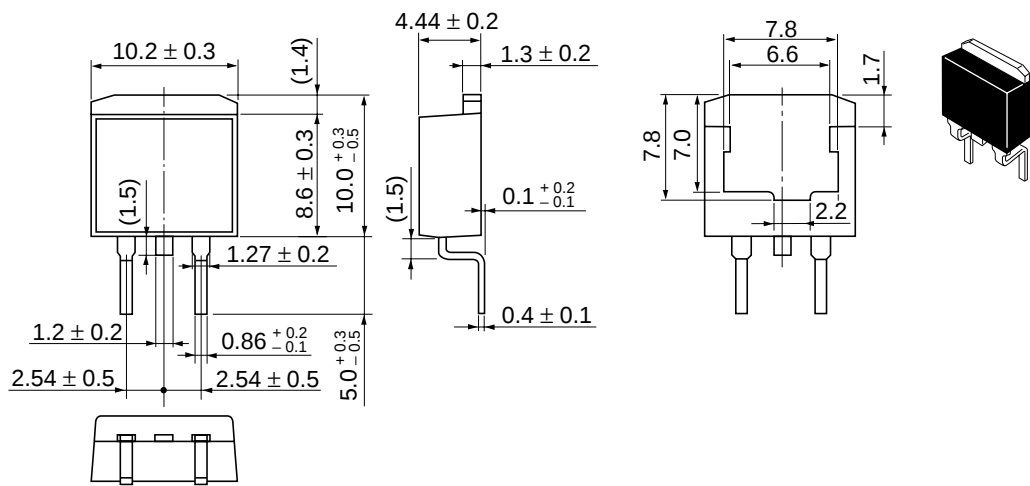
HAF1003(L), HAF1003(S)

As of January, 2001
Unit: mm



Hitachi Code	LDPAK (S)-(1)
JEDEC	—
EIAJ	—
Mass (reference value)	1.3 g

As of January, 2001
Unit: mm



Hitachi Code	LDPAK (S)-(2)
JEDEC	—
EIAJ	—
Mass (reference value)	1.35 g

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