2SK1401, 2SK1401A

Silicon N-Channel MOS FET

HITACHI

ADE-208-1281 (Z)
1st. Edition
Mar. 2001

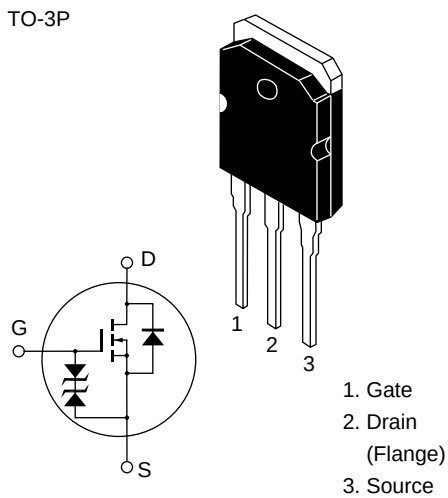
Application

High speed power switching

Features

- Low on-resistance
- High speed switching
- Low drive current
- No secondary breakdown
- Suitable for switching regulator and DC-DC converter

Outline



Hitachi semiconductor

Absolute Maximum Ratings (Ta = 25°C)

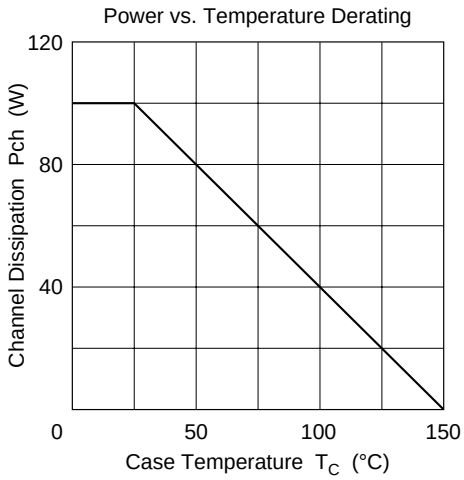
Item		Symbol	Ratings	Unit
Drain to source voltage	2SK1401	V_{DSS}	300	V
	2SK1401A		350	
Gate to source voltage		V_{GSS}	±30	V
Drain current		I_D	15	A
Drain peak current		$I_{D(pulse)}$ *1	60	A
Body to drain diode reverse drain current		I_{DR}	15	A
Channel dissipation		Pch*2	100	W
Channel temperature		Tch	150	°C
Storage temperature		Tstg	–55 to +150	°C

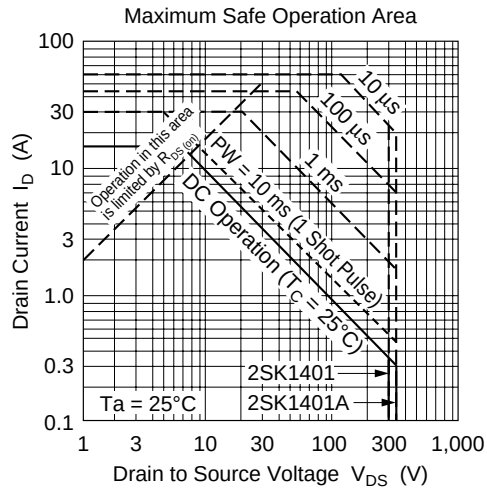
Notes: 1. PW 10 µs, duty cycle 1%
2. Value at T_C = 25°C

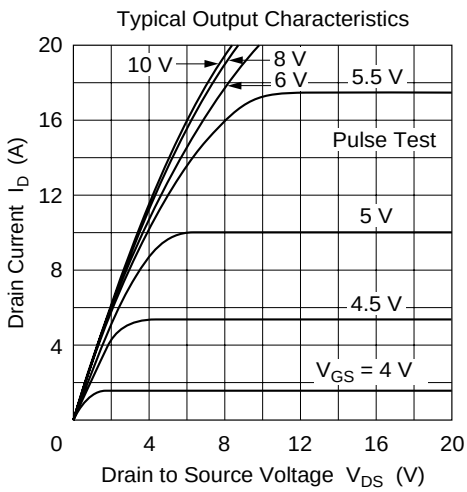
Electrical Characteristics (Ta = 25°C)

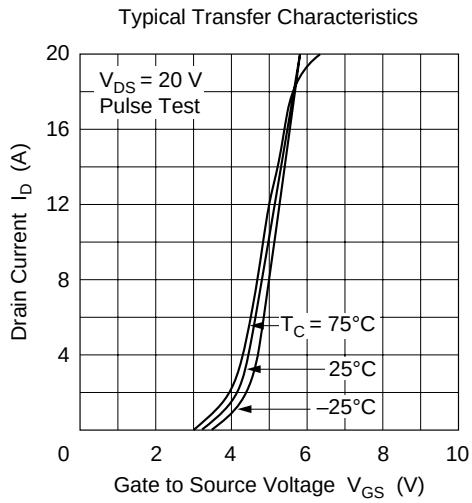
Item		Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	K1401	$V_{(BR)DSS}$	300	—	—	V	I_D = 10 mA, V_{GS} = 0
	K1401A		350	—	—		
Gate to source breakdown voltage		$V_{(BR)GSS}$	±30	—	—	V	I_G = ±100 µA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	±10	µA	V_{GS} = ±25 V, V_{DS} = 0
Zero gate voltage drain current	K1401	I_{DSS}	—	—	250	µA	V_{DS} = 240 V, V_{GS} = 0
	K1401A						V_{DS} = 280 V, V_{GS} = 0
Gate to source cutoff voltage		$V_{GS(off)}$	2.0	—	3.0	V	I_D = 1 mA, V_{DS} = 10 V
Static drain to source on state resistance	K1401	$R_{DS(on)}$	—	0.25	0.35		I_D = 8 A, V_{GS} = 10 V *[1]
	K1401A		—	0.30	0.40		
Forward transfer admittance		|yfs|	6	9.5	—	S	I_D = 8 A, V_{DS} = 10 V *[1]
Input capacitance		Ciss	—	1250	—	pF	V_{DS} = 10 V, V_{GS} = 0,
Output capacitance		Coss	—	420	—	pF	f = 1 MHz
Reverse transfer capacitance		Crss	—	70	—	pF	
Turn-on delay time		$t_{d(on)}$	—	15	—	ns	I_D = 8 A, V_{GS} = 10 V,
Rise time		t_r	—	80	—	ns	R_L = 3.75
Turn-off delay time		$t_{d(off)}$	—	100	—	ns	
Fall time		t_f	—	55	—	ns	
Body to drain diode forward voltage		V_{DF}	—	1.05	—	V	I_F = 15 A, V_{GS} = 0
Body to drain diode reverse recovery time		t_{rr}	—	370	—	ns	I_F = 15 A, V_{GS} = 0, di_F/dt = 100 A/µs

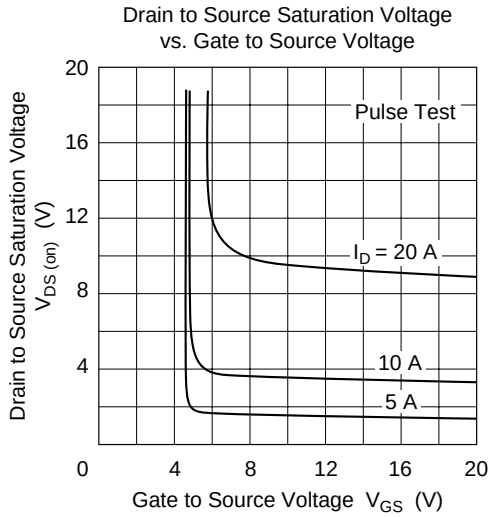
Note: 1. Pulse test

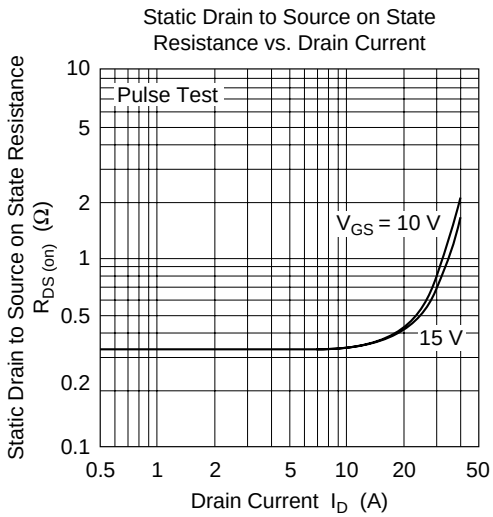

Power vs. Temperature Derating
Channel Dissipation Pch (W)
120
80
40
0
50
100
150
Case Temperature T_C (°C)

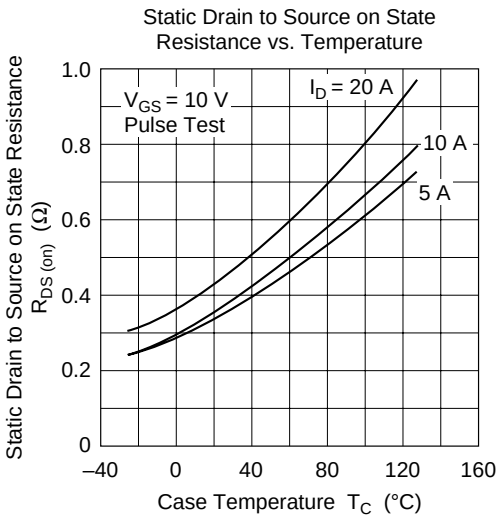

Maximum Safe Operation Area
Drain Current I_D (A)
100
30
10
3
1.0
0.3
0.1
1
3
10
30
100
300
1,000
Drain to Source Voltage V_{DS} (V)
10 µs
100 µs
1 ms
PW = 10 ms (1 Shot Pulse)
DC Operation (T_C = 25°C)
Operation in this area is limited by $R_{DS(on)}$
2SK1401
2SK1401A
Ta = 25°C

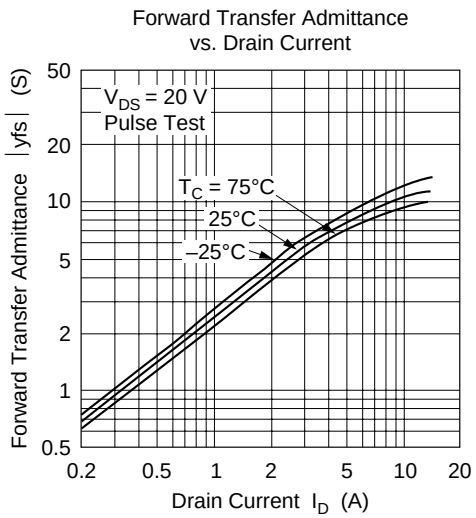

Typical Output Characteristics
Drain Current I_D (A)
20
16
12
8
4
0
4
8
12
16
20
Drain to Source Voltage V_{DS} (V)
10 V
8 V
6 V
5.5 V
Pulse Test
5 V
4.5 V
V_{GS} = 4 V

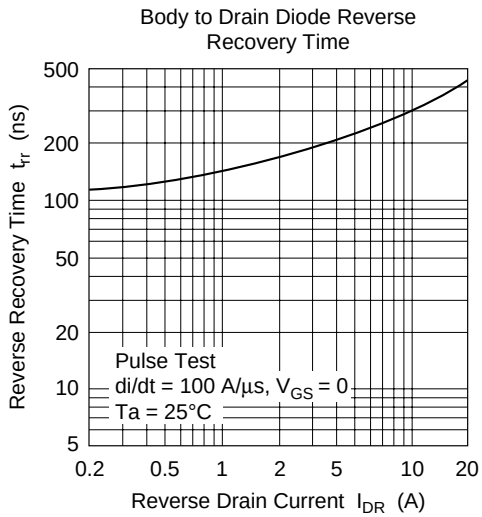

Typical Transfer Characteristics
Drain Current I_D (A)
20
16
12
8
4
0
2
4
6
8
10
Gate to Source Voltage V_{GS} (V)
V_{DS} = 20 V
Pulse Test
T_C = 75°C
25°C
–25°C

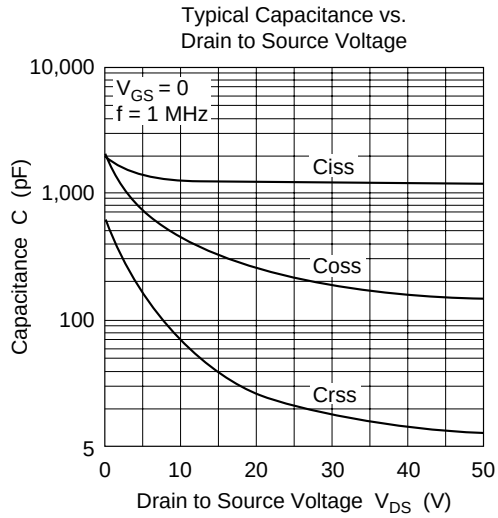

Drain to Source Saturation Voltage
vs. Gate to Source Voltage
Drain to Source Saturation Voltage
$V_{DS\ (on)}$ (V)
Pulse Test
I_D = 20 A
10 A
5 A
Gate to Source Voltage V_{GS} (V)
0
4
8
12
16
20

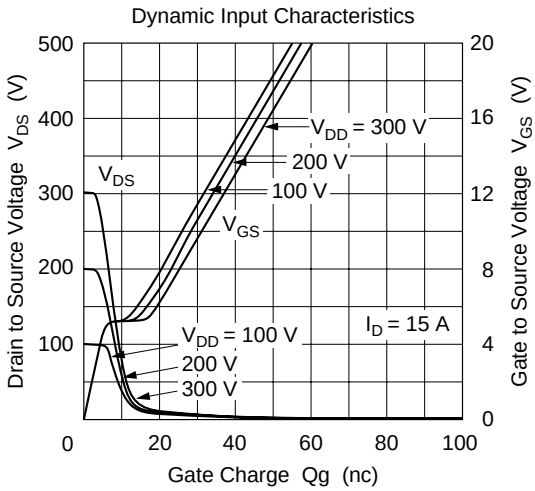

Static Drain to Source on State
Resistance vs. Drain Current
Static Drain to Source on State Resistance
$R_{DS\ (on)}$ (Ω)
Pulse Test
V_{GS} = 10 V
15 V
Drain Current I_D (A)
0.1
0.2
0.5
1
2
5
10
20
50

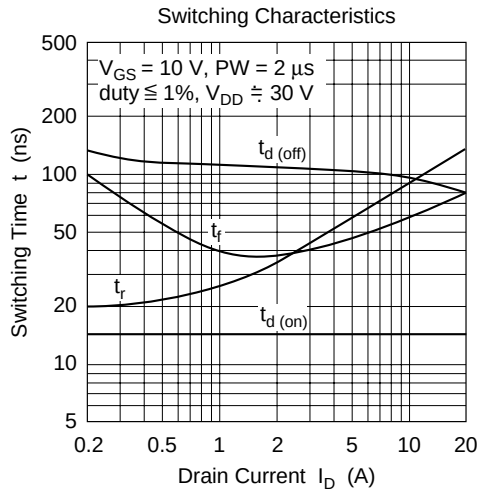

Static Drain to Source on State
Resistance vs. Temperature
Static Drain to Source on State Resistance
$R_{DS\ (on)}$ (Ω)
V_{GS} = 10 V
Pulse Test
I_D = 20 A
10 A
5 A
Case Temperature T_C (°C)
0
0.2
0.4
0.6
0.8
1.0
–40
0
40
80
120
160


Forward Transfer Admittance
vs. Drain Current
Forward Transfer Admittance |yfs| (S)
V_{DS} = 20 V
Pulse Test
T_C = 75°C
25°C
–25°C
Drain Current I_D (A)
0.5
1
2
5
10
20
50
0.2

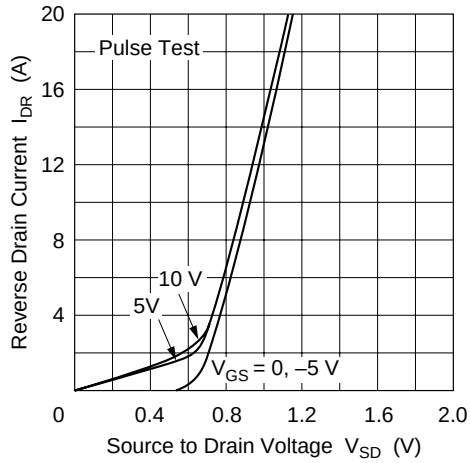

Body to Drain Diode Reverse Recovery Time
Reverse Recovery Time t_{rr} (ns)
500
200
100
50
20
10
5
Pulse Test
di/dt = 100 A/µs, V_{GS} = 0
Ta = 25°C
0.2
0.5
1
2
5
10
20
Reverse Drain Current I_{DR} (A)


Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
10,000
1,000
100
5
V_{GS} = 0
f = 1 MHz
Ciss
Coss
Crss
0
10
20
30
40
50
Drain to Source Voltage V_{DS} (V)

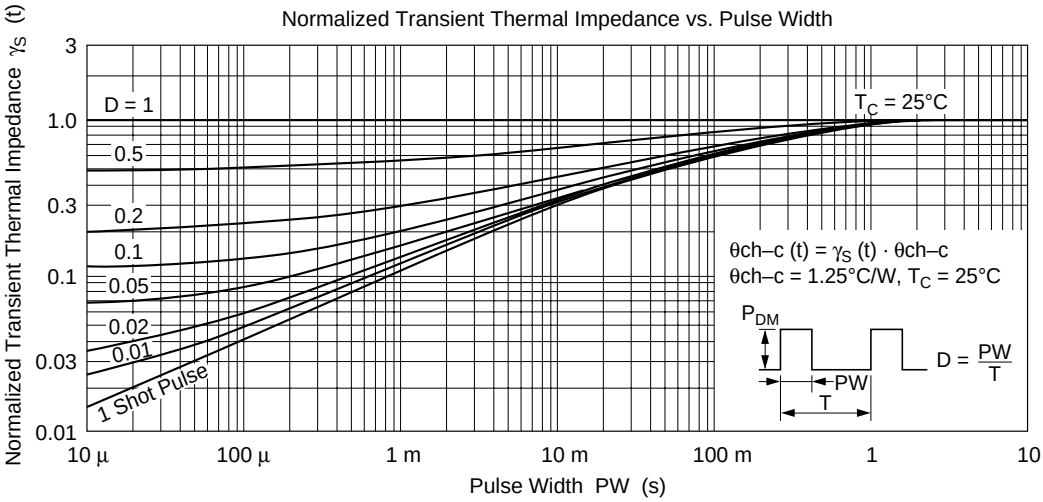

Dynamic Input Characteristics
Drain to Source Voltage V_{DS} (V)
500
400
300
200
100
Gate to Source Voltage V_{GS} (V)
20
16
12
8
4
0
V_{DS}
V_{DD} = 300 V
200 V
100 V
V_{GS}
V_{DD} = 100 V
200 V
300 V
I_D = 15 A
0
20
40
60
80
100
Gate Charge Qg (nc)


Switching Characteristics
Switching Time t (ns)
500
200
100
50
20
10
5
V_{GS} = 10 V, PW = 2 µs
duty ≦ 1%, V_{DD} ≒ 30 V
$t_{d (off)}$
t_f
t_r
$t_{d (on)}$
0.2
0.5
1
2
5
10
20
Drain Current I_D (A)

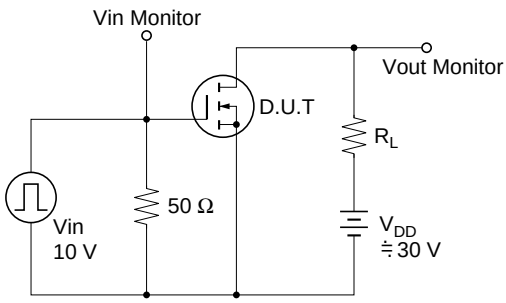
Reverse Drain Current vs.
Source to Drain Voltage



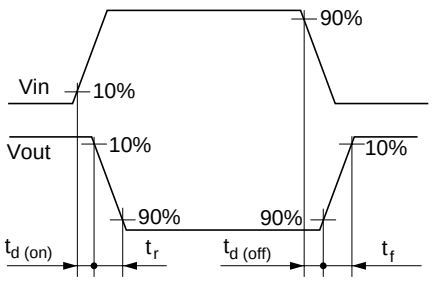
Normalized Transient Thermal Impedance vs. Pulse Width



Switching Time Test Circuit



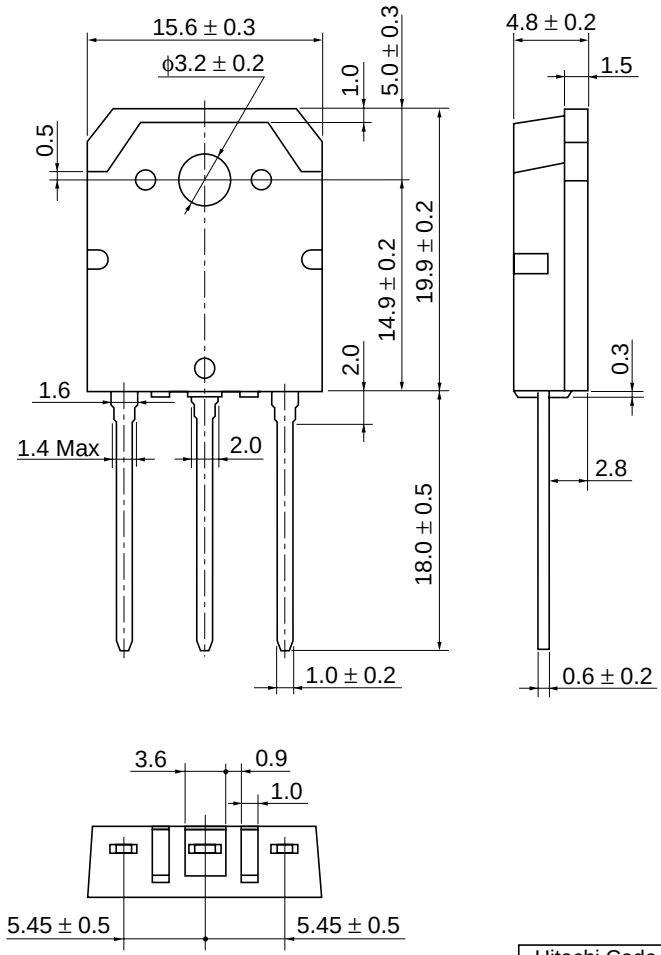
Waveforms

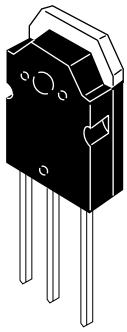


Package Dimensions

As of January, 2001

Unit: mm





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Mass (reference value)	5.0 g

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