2SK1401, 2SK1401A

Silicon N-Channel MOS FET

HITACHI

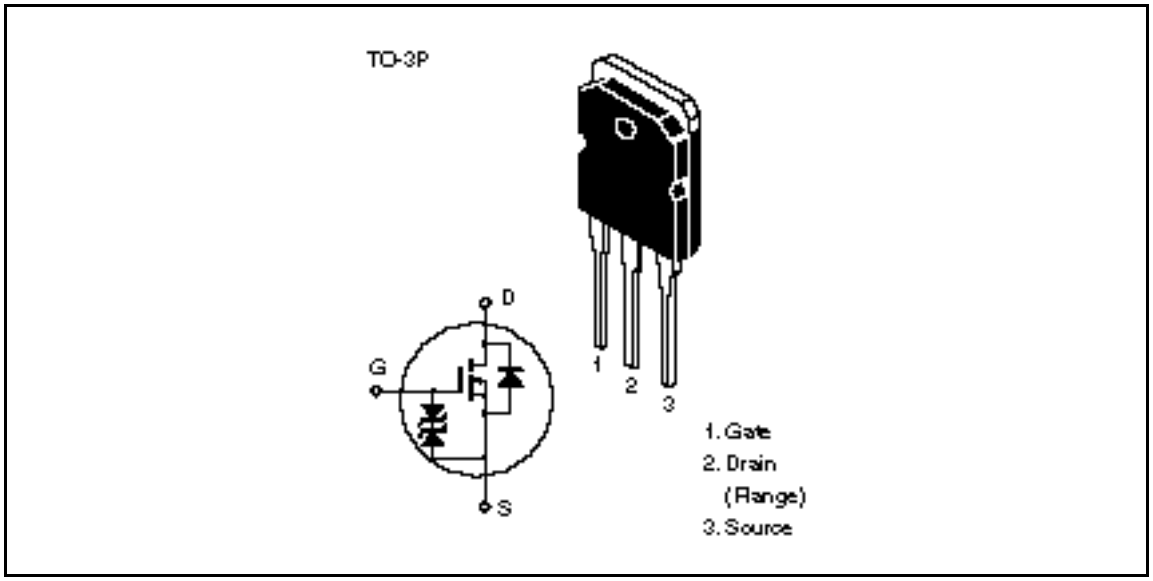
Application

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)

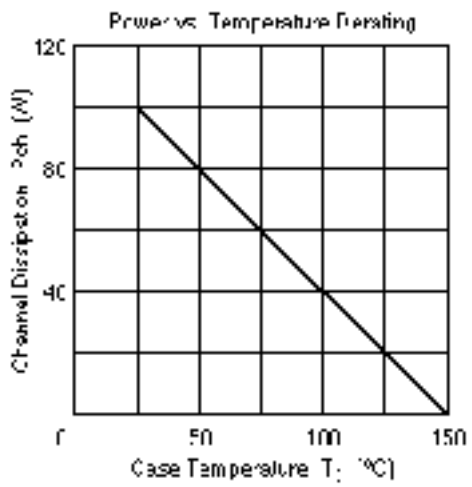
Item		Symbol	Ratings	Unit
Drain to source voltage	2SK1401	V_{DSS}	300	V
	2SK1401A		350	
Gate to source voltage		V_{GSS}	±30	V
Drain current		I_D	15	A
Drain peak current		$I_{D(pulse)}$*[1]	60	A
Body to drain diode reverse drain current		I_{DR}	15	A
Channel dissipation		Pch*[2]	100	W
Channel temperature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

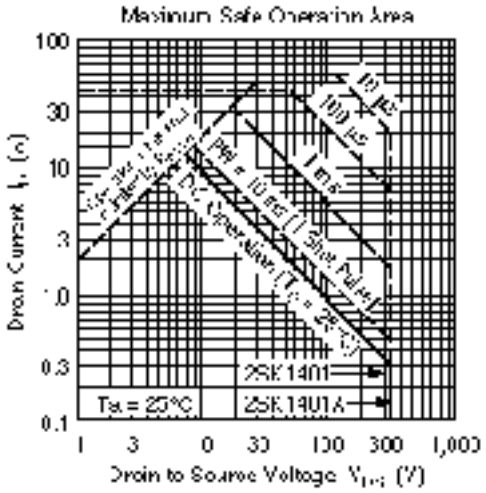
Notes: 1. PW ≤ 10 µs, duty cycle ≤ 1%
2. Value at T_C = 25°C

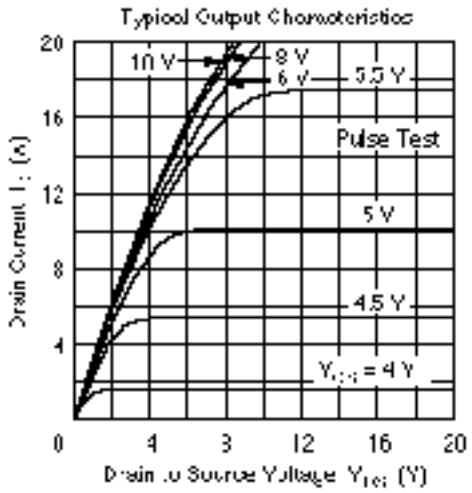
Electrical Characteristics (Ta = 25°C)

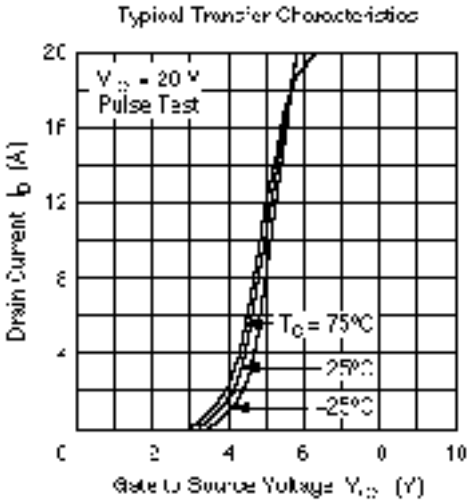
Item		Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	K1401	$V_{(BR)DSS}$	300	—	—	V	I_D = 10 mA, V_{GS} = 0
	K1401A		350	—	—		
Gate to source breakdown voltage		$V_{(BR)GSS}$	±30	—	—	V	I_G = ±100 µA, V_{DS} = 0
Gate to source leak current		I_{GSS}	—	—	±10	µA	V_{GS} = ±25 V, 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	Ω	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, f = 1 MHz
Output capacitance		Coss	—	420	—	pF	
Reverse transfer capacitance		Crss	—	70	—	pF	
Turn-on delay time		$t_{d(on)}$	—	15	—	ns	I_D = 8 A, V_{GS} = 10 V, R_L = 3.75 Ω
Rise time		t_r	—	80	—	ns	
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

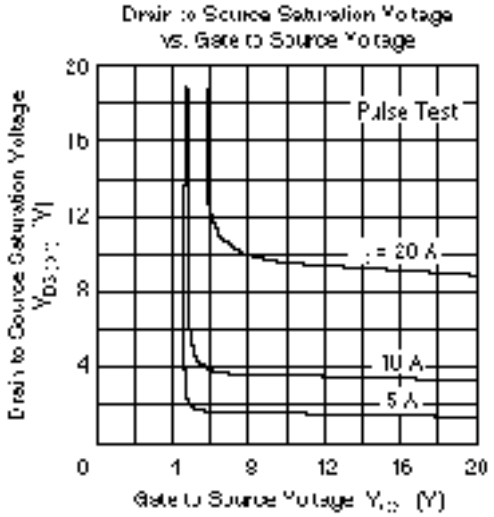
Note: 1. Pulse test

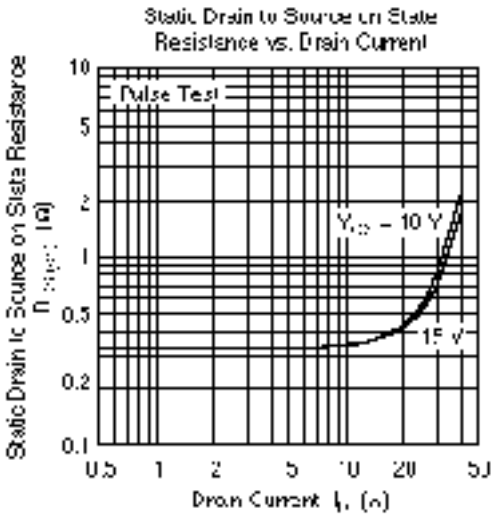

Power vs. Temperature Derating
Channel Dissipation Pch (W)
120
80
40
0
50
100
150
Case Temperature Tc (°C)

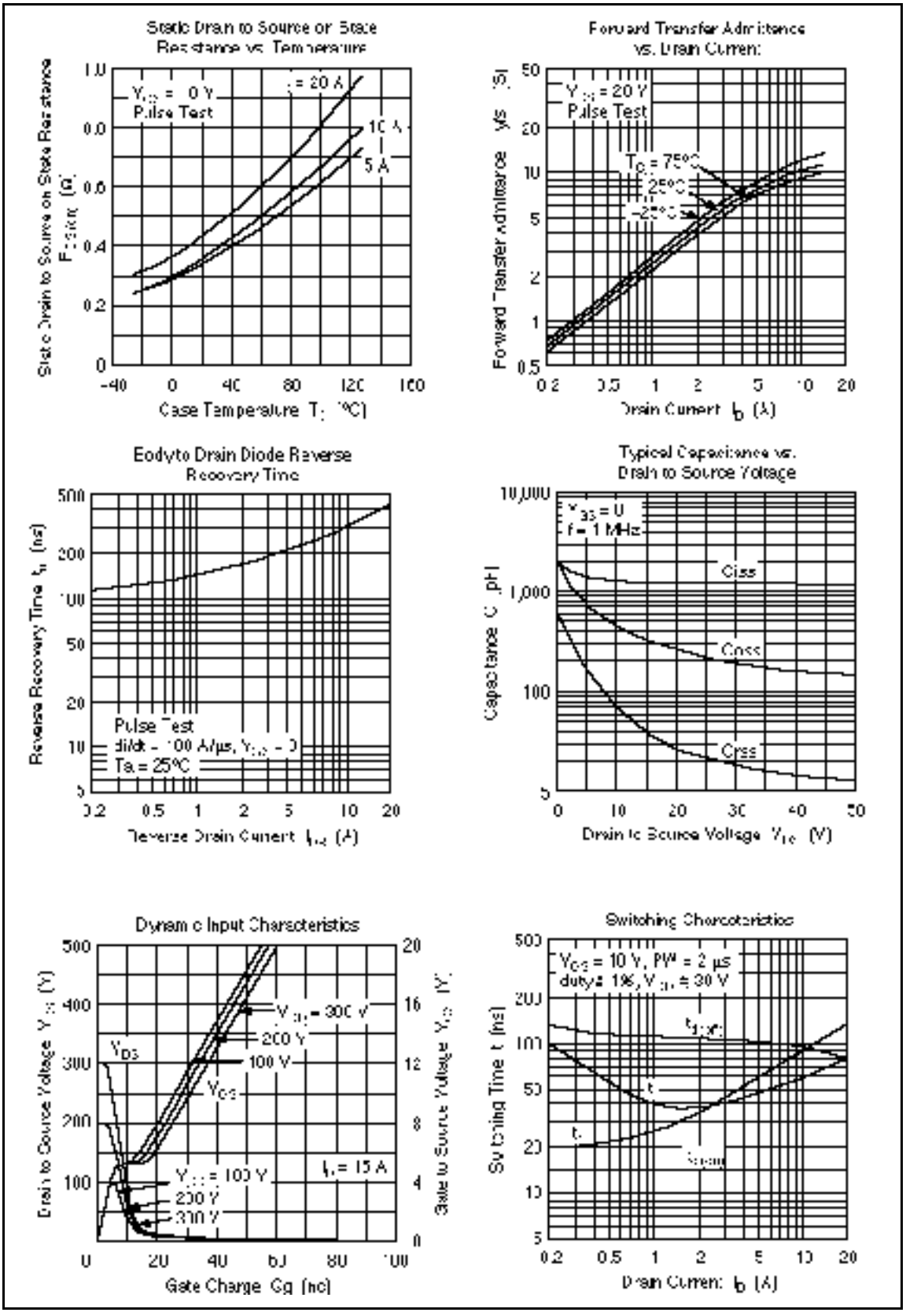

Maximum Safe Operation Area
Drain Current ID (A)
100
30
10
3
1.0
0.3
0.1
1
3
10
30
100
300
1,000
Drain to Source Voltage VDS (V)
PW = 10 µs (1 Shot Pulse)
DC Operation (Tc = 25°C)
2SK1401
2SK1401A
Ta = 25°C

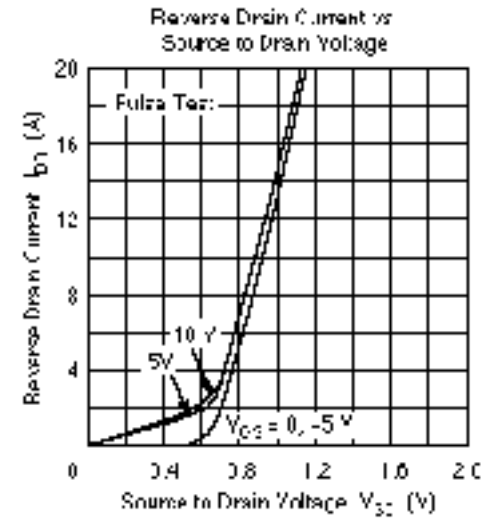

Typical Output Characteristics
Drain Current ID (A)
20
16
12
8
4
0
4
8
12
16
20
Drain to Source Voltage VDS (V)
10 V
8 V
6 V
5.5 V
Pulse Test
5 V
4.5 V
VGS = 4 V

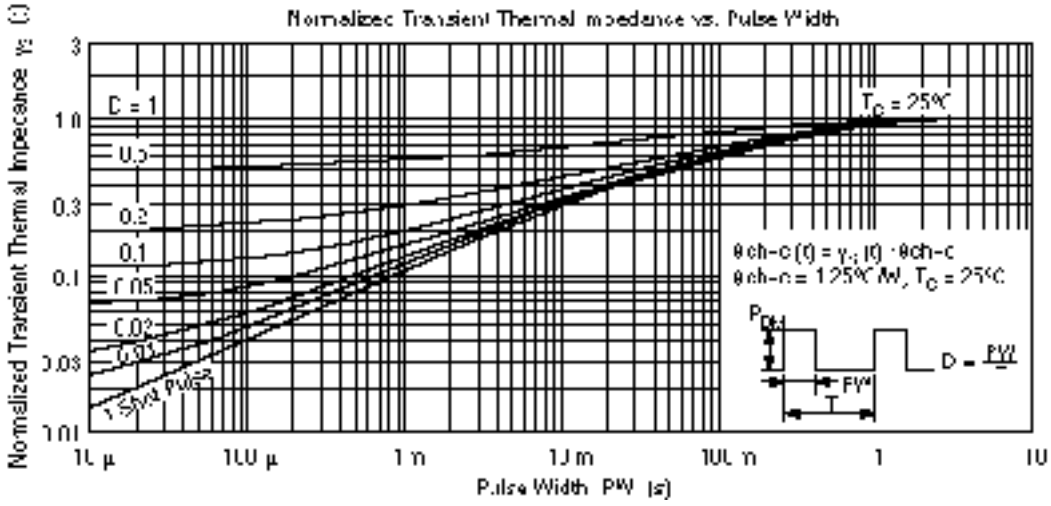

Typical Transfer Characteristics
Drain Current ID (A)
20
16
12
8
4
0
2
4
6
8
10
Gate to Source Voltage VGS (V)
VDS = 20 V
Pulse Test
Tc = 75°C
25°C
-25°C

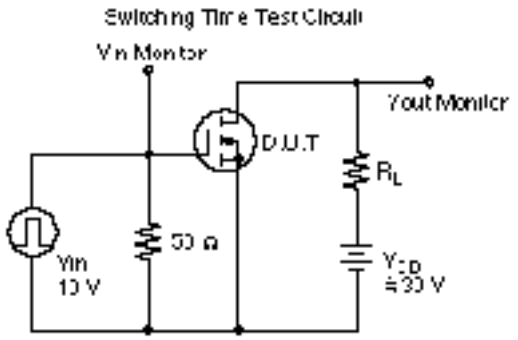

Drain to Source Saturation Voltage
vs. Gate to Source Voltage
Drain to Source Saturation Voltage
VDS(on) (V)
20
16
12
8
4
0
4
8
12
16
20
Gate to Source Voltage VGS (V)
Pulse Test
ID = 20 A
10 A
5 A

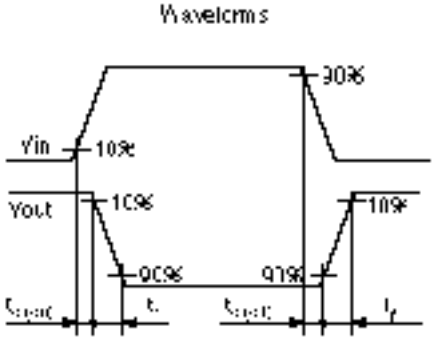

Static Drain to Source on State
Resistance vs. Drain Current
Static Drain to Source on State Resistance
RDS(on) (Ω)
10
5
2
1
0.5
0.2
0.1
0.5
1
2
5
10
20
50
Drain Current ID (A)
Pulse Test
VGS = 10 V
15 V


Static Drain to Source on State Resistance vs. Temperature
Static Drain to Source on State Resistance
Case Temperature
Pulse Test
10 A
5 A
Forward Transfer Admittance vs. Drain Current
Forward Transfer Admittance
Drain Current
Pulse Test
25°C
Body to Drain Diode Reverse Recovery Time
Reverse Recovery Time
Reverse Drain Current
Pulse Test
Ta = 25°C
Typical Capacitance vs. Drain to Source Voltage
Capacitance
Drain to Source Voltage
f = 1 MHz
Ciss
Coss
Crss
Dynamic Input Characteristics
Drain to Source Voltage
Gate to Source Voltage
Gate Charge
Switching Characteristics
Switching Time
Drain Current


Reverse Drain Current vs
Source to Drain Voltage
Pulse Test
Reverse Drain Current I_{DR} (A)
20
16
12
8
4
10 V
5V
V_{GS} = 0, -5 V
0
0.4
0.8
1.2
1.6
2.0
Source to Drain Voltage V_{SD} (V)


Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance γ_s (t)
3
1.0
0.3
0.1
0.03
0.01
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1 Shot Pulse
T_C = 25°C
$\theta ch-c(t) = \gamma_s(t) \cdot \theta ch-c$
$\theta ch-c$ = 125°C/W, T_C = 25°C
P_{DM}
D = PW/T
PW
T
10 µ
100 µ
1 m
10 m
100 m
1
10
Pulse Width PW (s)


Switching Time Test Circuit
Vin Monitor
Vout Monitor
D.U.T
R_L
50 Ω
Vin
10 V
V_{DD}
≒30 V


Waveforms
90%
Vin
10%
Vout
10%
10%
90%
90%
$t_{d(on)}$
t_r
$t_{d(off)}$
t_f

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