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2SK1302

Silicon N-Channel MOS FET

HITACHI

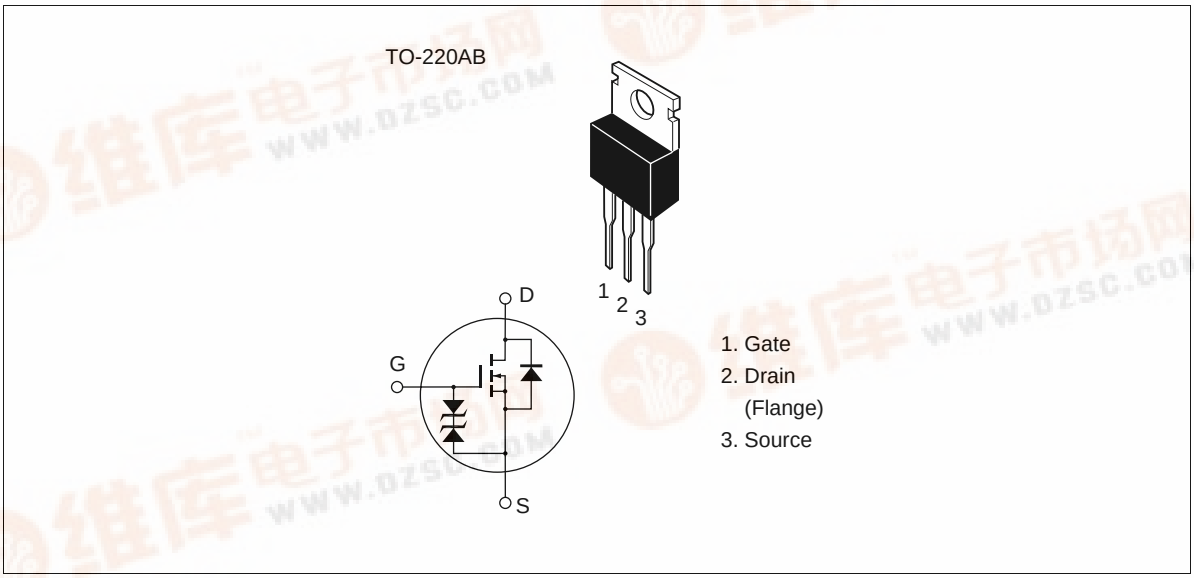
Application

High speed power switching

Features

- Low on-resistance
- High speed switching
- 4 V gate drive device
  — Can be driven from 5 V source
- Suitable for motor drive, DC-DC converter, power switch and solenoid drive

Outline



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Absolute Maximum Ratings (Ta = 25°C)

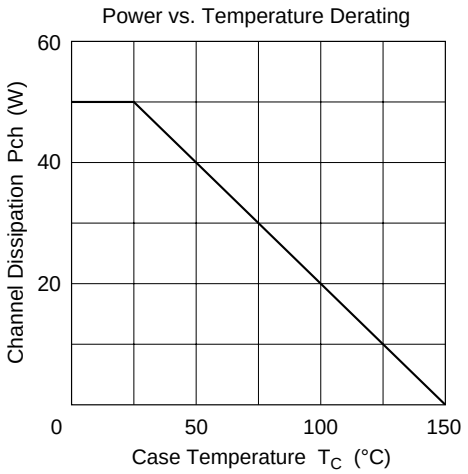
Item	Symbol	Ratings	Unit
Drain to source voltage	$V_{(BR)DSS}$	100	V
Gate to source voltage	V_{GSS}	±20	V
Drain current	I_D	20	A
Drain peak current	$I_{D(pulse)}$ *1	80	A
Body to drain diode reverse drain current	I_{DR}	20	A
Channel dissipation	Pch*2	50	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

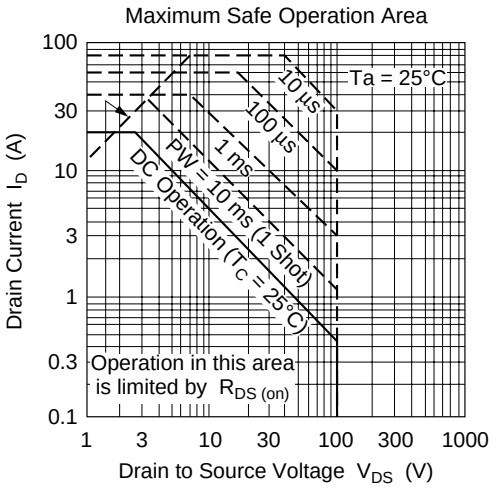
Notes: 1. PW ≤ 10 µs, duty cycle ≤ 1%
2. Value at T_C = 25°C

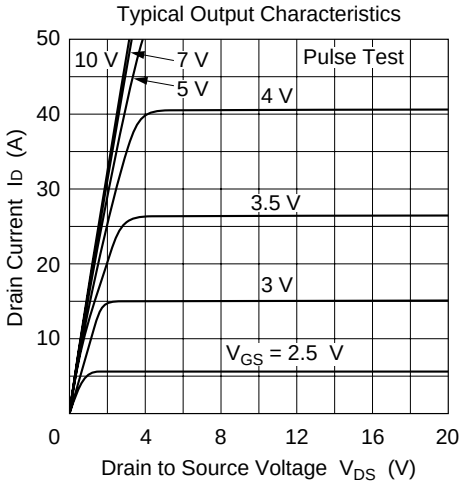
Electrical Characteristics (Ta = 25°C)

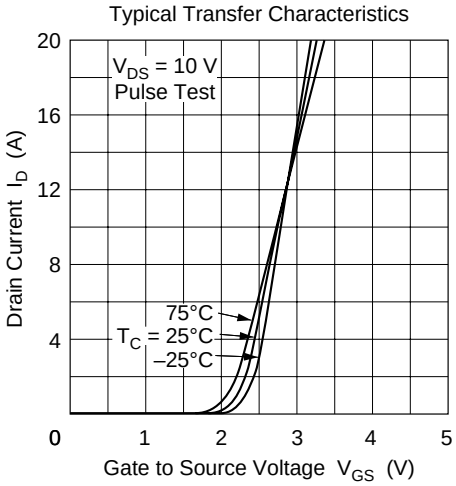
Item	Symbol	Min	Typ	Max	Unit	Test conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	100	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 µA, V_{DS} = 0
Gate to source leak current	I_{GSS}	—	—	±10	µA	V_{GS} = ±16 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	250	µA	V_{DS} = 80 V, V_{GS} = 0
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.0	V	I_D = 1 mA, V_{DS} = 10 V
Static drain to source on state resistance	$R_{DS(on)}$	—	0.065	0.085	Ω	I_D = 10 A, V_{GS} = 10 V *[1]
		—	0.085	0.12	Ω	I_D = 10 A, V_{GS} = 4 V *[1]
Forward transfer admittance	|yfs|	10	16	—	S	I_D = 10 A, V_{DS} = 10 V *[1]
Input capacitance	Ciss	—	1300	—	pF	V_{DS} = 10 V, V_{GS} = 0,
Output capacitance	Coss	—	540	—	pF	f = 1 MHz
Reverse transfer capacitance	Crss	—	160	—	pF	
Turn-on delay time	$t_{d(on)}$	—	12	—	ns	I_D = 10 A, V_{GS} = 10 V,
Rise time	t_r	—	100	—	ns	R_L = 3 Ω
Turn-off delay time	$t_{d(off)}$	—	300	—	ns	
Fall time	t_f	—	150	—	ns	
Body to drain diode forward voltage	V_{DF}	—	1.3	—	V	I_F = 20 A, V_{GS} = 0
Body to drain diode reverse recovery time	t_{rr}	—	300	—	ns	I_F = 20 A, V_{GS} = 0, di_F/dt = 50 A/µs

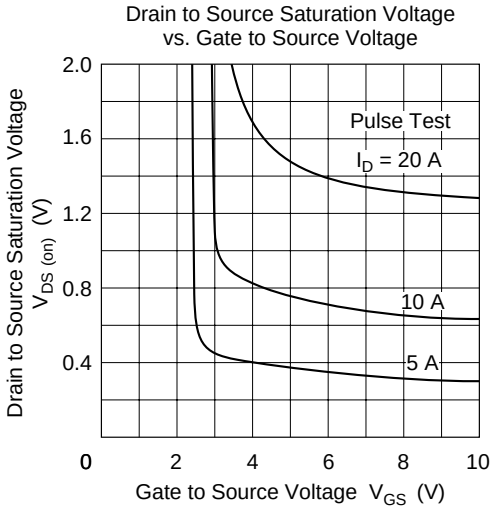
Note: 1. Pulse test

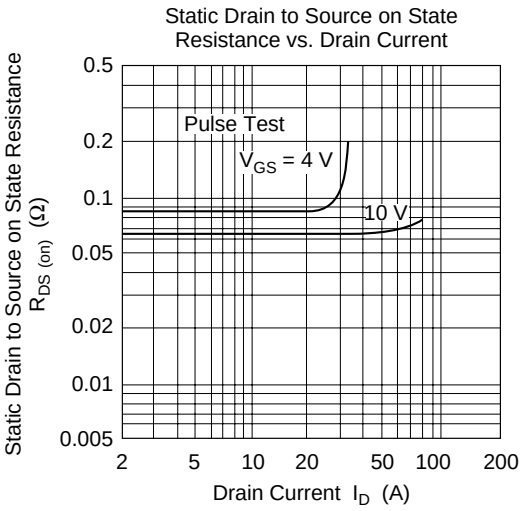

Power vs. Temperature Derating
Channel Dissipation Pch (W)
60
40
20
0
50
100
150
Case Temperature T_C (°C)

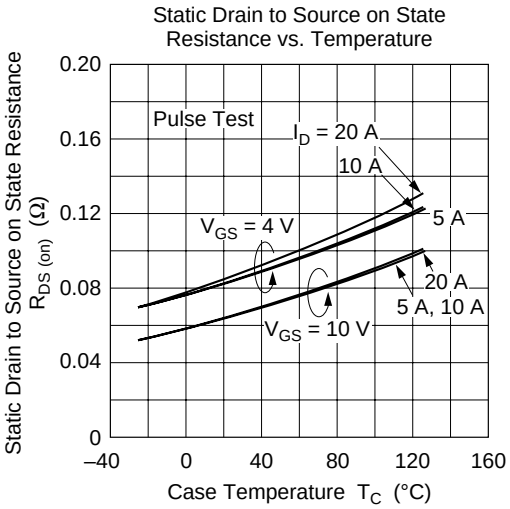

Maximum Safe Operation Area
Drain Current I_D (A)
100
30
10
3
1
0.3
0.1
Ta = 25°C
10 µs
100 µs
1 ms
PW = 10 ms (1 Shot)
DC Operation (T_C = 25°C)
Operation in this area
is limited by $R_{DS\ (on)}$
1
3
10
30
100
300
1000
Drain to Source Voltage V_{DS} (V)

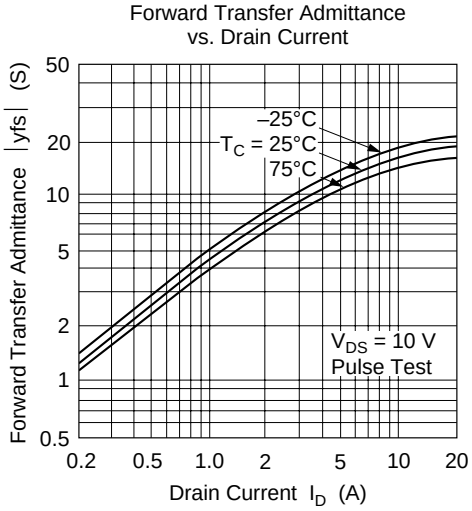

Typical Output Characteristics
Drain Current I_D (A)
50
40
30
20
10
10 V
7 V
5 V
Pulse Test
4 V
3.5 V
3 V
V_{GS} = 2.5 V
0
4
8
12
16
20
Drain to Source Voltage V_{DS} (V)

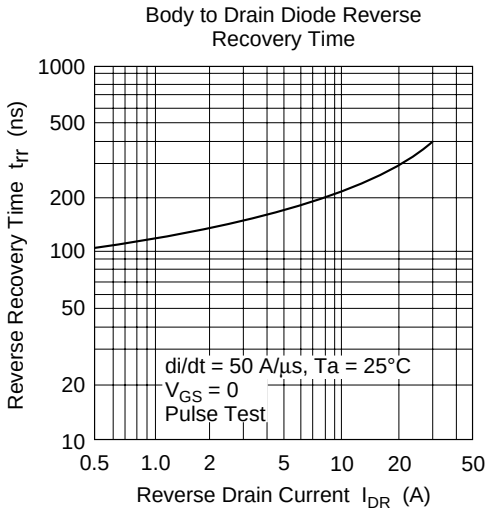

Typical Transfer Characteristics
Drain Current I_D (A)
20
16
12
8
4
V_{DS} = 10 V
Pulse Test
75°C
T_C = 25°C
–25°C
0
1
2
3
4
5
Gate to Source Voltage V_{GS} (V)

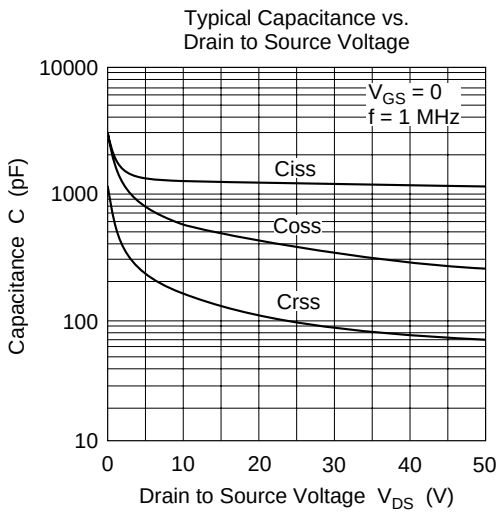

Drain to Source Saturation Voltage
vs. Gate to Source Voltage
Drain to Source Saturation Voltage
$V_{DS\ (on)}$ (V)
2.0
1.6
1.2
0.8
0.4
0
2
4
6
8
10
Gate to Source Voltage V_{GS} (V)
Pulse Test
I_D = 20 A
10 A
5 A

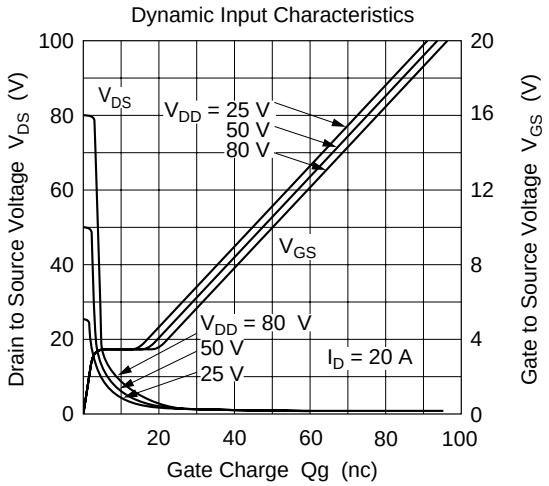

Static Drain to Source on State
Resistance vs. Drain Current
Static Drain to Source on State Resistance
$R_{DS\ (on)}$ (Ω)
0.5
0.2
0.1
0.05
0.02
0.01
0.005
2
5
10
20
50
100
200
Drain Current I_D (A)
Pulse Test
V_{GS} = 4 V
10 V

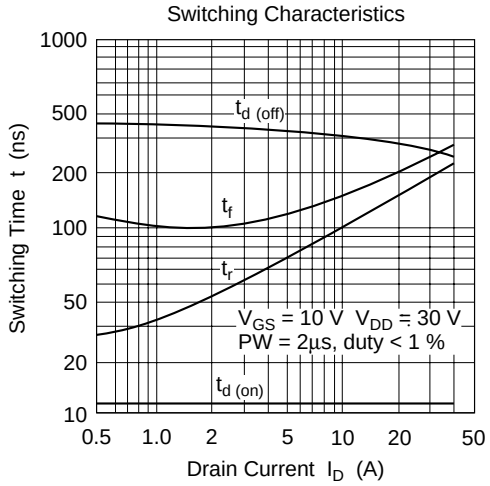

Static Drain to Source on State
Resistance vs. Temperature
Static Drain to Source on State Resistance
$R_{DS\ (on)}$ (Ω)
0.20
0.16
0.12
0.08
0.04
0
–40
0
40
80
120
160
Case Temperature T_C (°C)
Pulse Test
I_D = 20 A
10 A
5 A
V_{GS} = 4 V
20 A
5 A, 10 A
V_{GS} = 10 V


Forward Transfer Admittance
vs. Drain Current
Forward Transfer Admittance |yfs| (S)
50
20
10
5
2
1
0.5
0.2
0.5
1.0
2
5
10
20
Drain Current I_D (A)
–25°C
T_C = 25°C
75°C
V_{DS} = 10 V
Pulse Test

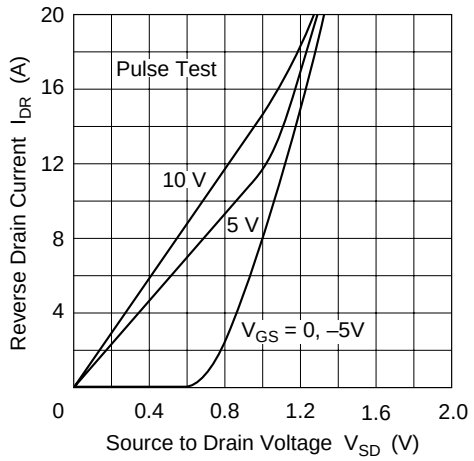

Body to Drain Diode Reverse
Recovery Time
Reverse Recovery Time trr (ns)
1000
500
200
100
50
20
10
0.5
1.0
2
5
10
20
50
Reverse Drain Current IDR (A)
di/dt = 50 A/µs, Ta = 25°C
VGS = 0
Pulse Test


Typical Capacitance vs.
Drain to Source Voltage
Capacitance C (pF)
10000
1000
100
10
0
10
20
30
40
50
Drain to Source Voltage VDS (V)
VGS = 0
f = 1 MHz
Ciss
Coss
Crss

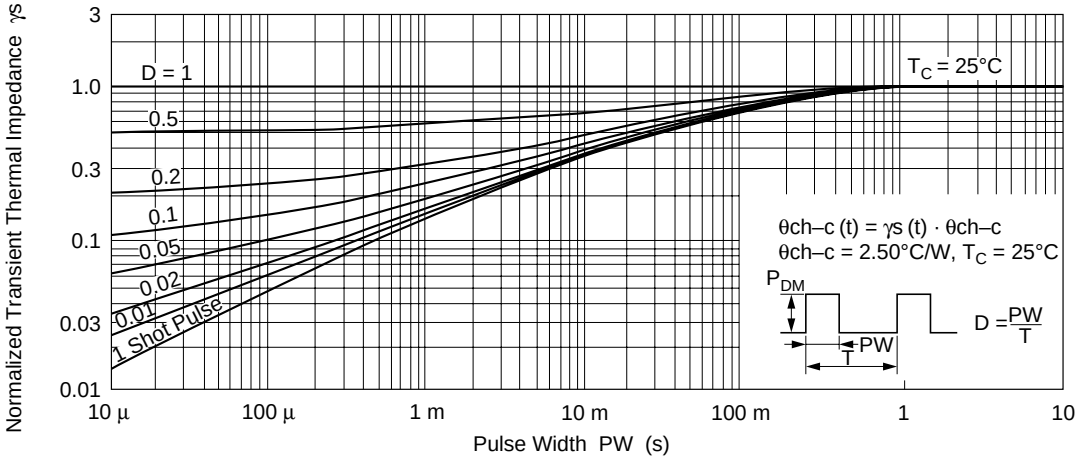

Dynamic Input Characteristics
Drain to Source Voltage VDS (V)
100
80
60
40
20
0
Gate to Source Voltage VGS (V)
20
16
12
8
4
0
20
40
60
80
100
Gate Charge Qg (nc)
VDS
VDD = 25 V
50 V
80 V
VGS
VDD = 80 V
50 V
25 V
ID = 20 A


Switching Characteristics
Switching Time t (ns)
1000
500
200
100
50
20
10
0.5
1.0
2
5
10
20
50
Drain Current ID (A)
td (off)
tf
tr
td (on)
VGS = 10 V VDD = 30 V
PW = 2µs, duty < 1 %

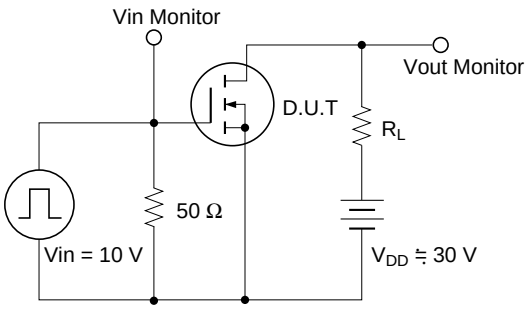
Reverse Drain Current vs.
Source to Drain Voltage



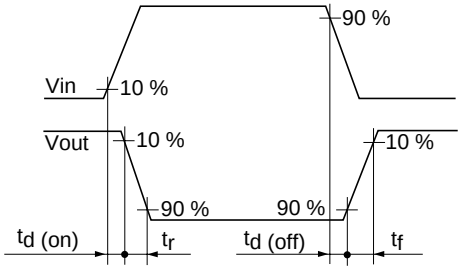
Normalized Transient Thermal Impedance vs. Pulse Width



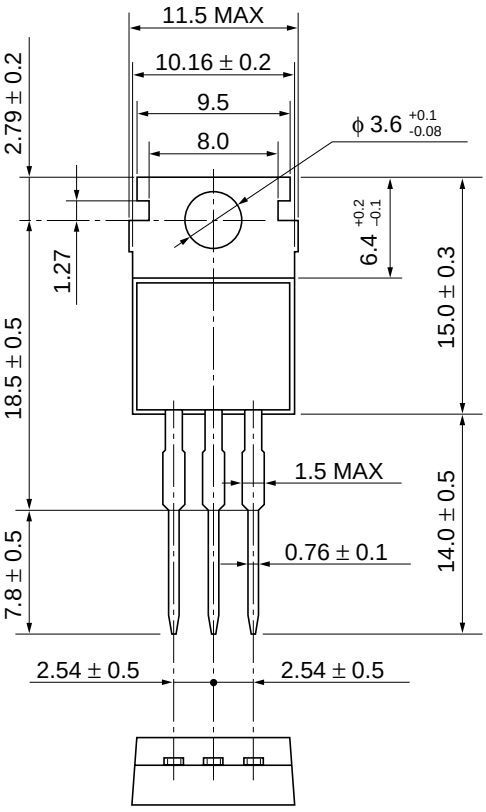
Switching Time Test Circuit

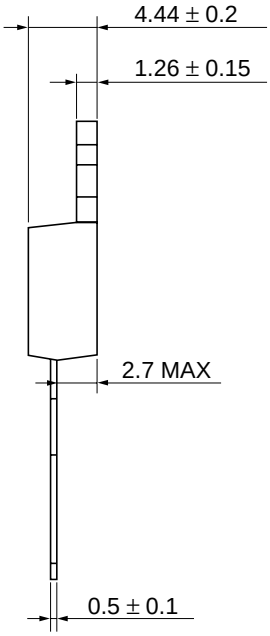


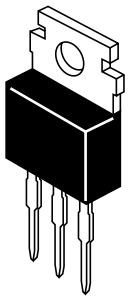
Wavewforms



Unit: mm


11.5 MAX
10.16 ± 0.2
9.5
8.0
ϕ 3.6 +0.1 -0.08
2.79 ± 0.2
1.27
6.4 +0.2 -0.1
15.0 ± 0.3
18.5 ± 0.5
1.5 MAX
14.0 ± 0.5
0.76 ± 0.1
7.8 ± 0.5
2.54 ± 0.5
2.54 ± 0.5


4.44 ± 0.2
1.26 ± 0.15
2.7 MAX
0.5 ± 0.1



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