2SK2554

Silicon N-Channel MOS FET

HITACHI

ADE-208-359 D
5th. Edition

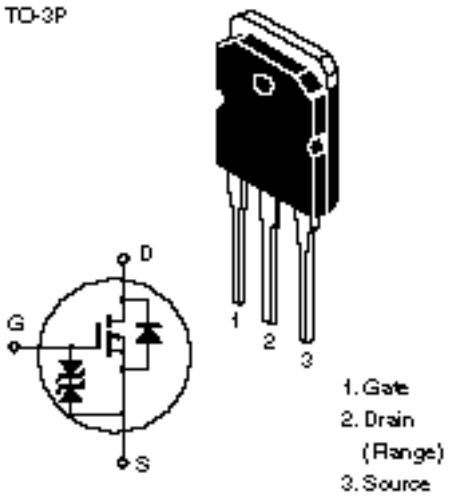
Application

High speed power switching

Features

- Low on-resistance
- $R_{DS(on)}$ = 4.5 mΩ typ.
- High speed switching
- 4 V gate drive device can be driven from 5 V source

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}	±20	V
Drain current	I_D	75	A
Drain peak current	$I_{D(pulse)}$*[1]	300	A
Body to drain diode reverse drain current	I_{DR}*[2]	75	A
Avalanche current	I_{AP}*[3]	50	A
Avalanche energy	E_{AR}*[3]	214	mJ
Channel dissipation	Pch*[2]	150	W
Channel temperature	Tch	150	°C
Storage temperature	Tstg	–55 to +150	°C

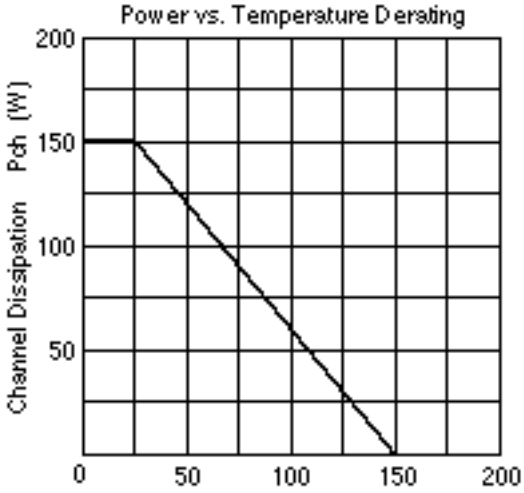
Notes: 1. PW ≤ 10 µs, duty cycle ≤ 1 %
2. Value at Tc = 25°C
3. Value at Tch = 25°C, Rg ≥ 50 Ω

Electrical Characteristics (Ta = 25°C)

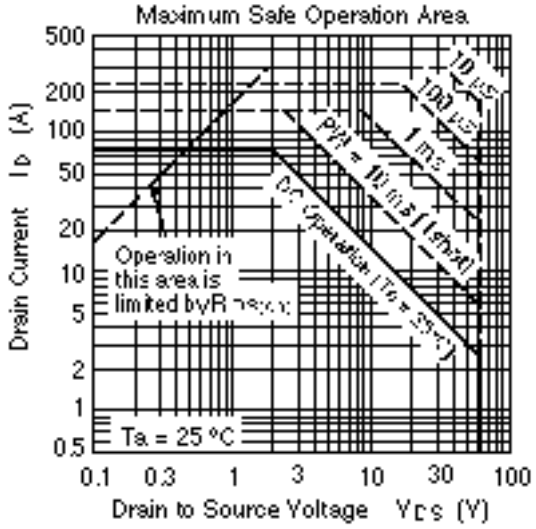
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	60	—	—	V	I_D = 10 mA, V_{GS} = 0
Gate to source breakdown voltage	$V_{(BR)GSS}$	±20	—	—	V	I_G = ±100 µA, V_{DS} = 0
Gate to source leak current	I_{GSS}	—	—	±10	µA	V_{GS} = ±16 V, V_{DS} = 0
Zero gate voltage drain current	I_{DSS}	—	—	100	µA	V_{DS} = 60 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	$R_{DS(on)}$	—	4.5	6	mΩ	I_D = 40 A V_{GS} = 10 V*[1]
		—	5.8	10	mΩ	I_D = 40 A V_{GS} = 4 V*[1]
Forward transfer admittance	$\|y_{fs}\|$	50	80	—	S	I_D = 40 A V_{DS} = 10 V*[1]
Input capacitance	Ciss	—	7700	—	pF	V_{DS} = 10 V
Output capacitance	Coss	—	4100	—	pF	V_{GS} = 0
Reverse transfer capacitance	Crss	—	760	—	pF	f = 1 MHz
Turn-on delay time	$t_{d(on)}$	—	60	—	ns	I_D = 40 A
Rise time	t_r	—	420	—	ns	V_{GS} = 10 V
Turn-off delay time	$t_{d(off)}$	—	1200	—	ns	R_L = 0.75 Ω
Fall time	t_f	—	900	—	ns	
Body to drain diode forward voltage	V_{DF}	—	0.95	—	V	I_F = 75 A, V_{GS} = 0
Body to drain diode reverse recovery time	t_{rr}	—	105	—	ns	I_F = 75 A, V_{GS} = 0 diF / dt = 50 A / µs

Note: 1. Pulse Test

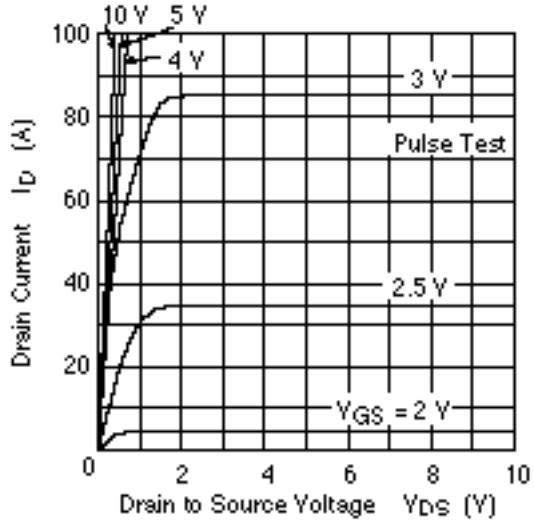
Power vs. Temperature Derating



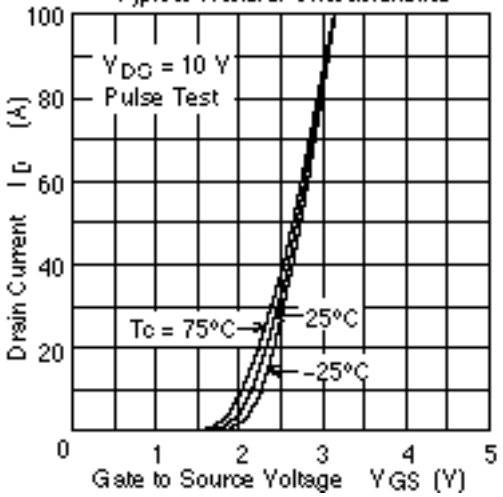
Maximum Safe Operation Area

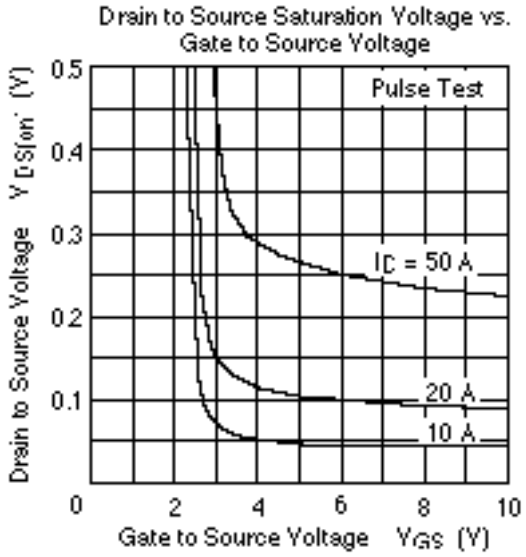


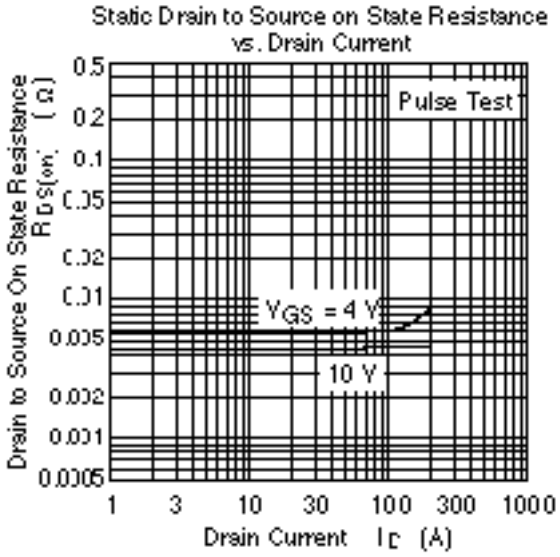
Typical Output Characteristics



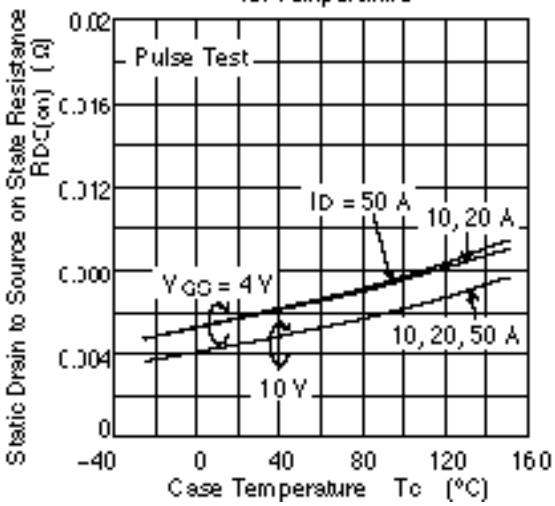
Typical Transfer Characteristics



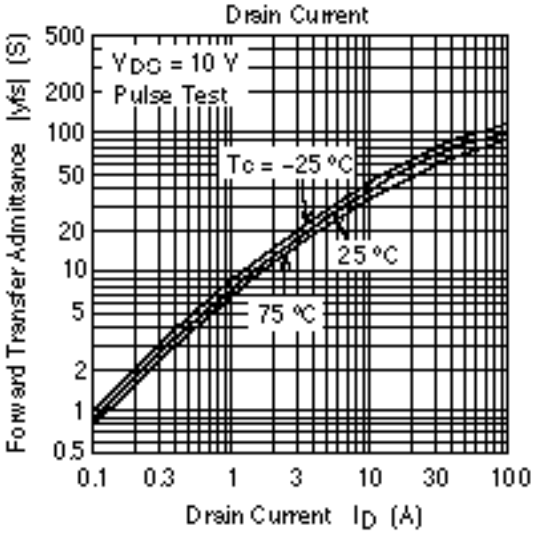

Drain to Source Saturation Voltage vs.
Gate to Source Voltage
Pulse Test
ID = 50 A
20 A
10 A
Drain to Source Voltage VDS(on) (V)
Gate to Source Voltage VGS (V)
0.5
0.4
0.3
0.2
0.1
0
2
4
6
8
10

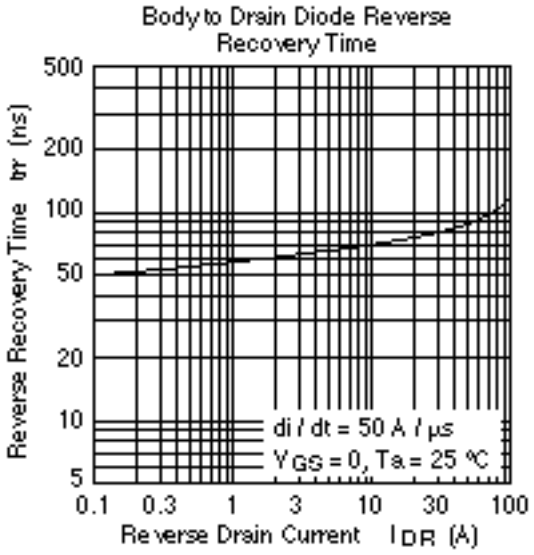

Static Drain to Source on State Resistance
vs. Drain Current
Pulse Test
VGS = 4 V
10 V
Drain to Source On State Resistance RDS(on) (Ω)
Drain Current ID (A)
0.5
0.2
0.1
0.05
0.02
0.01
0.005
0.002
0.001
0.0005
1
3
10
30
100
300
1000

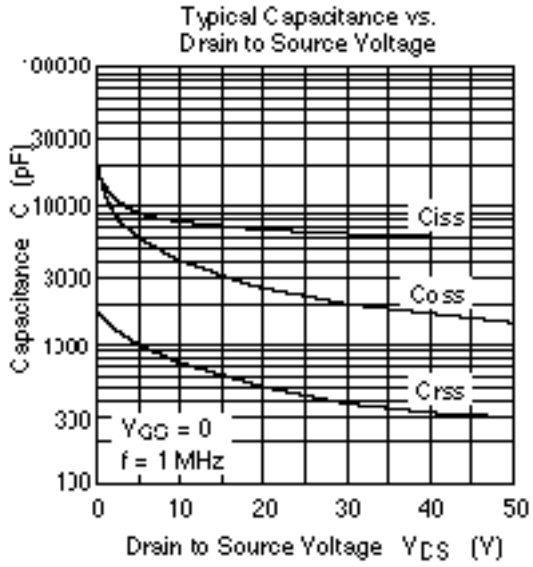
Static Drain to Source on State Resistance vs. Temperature

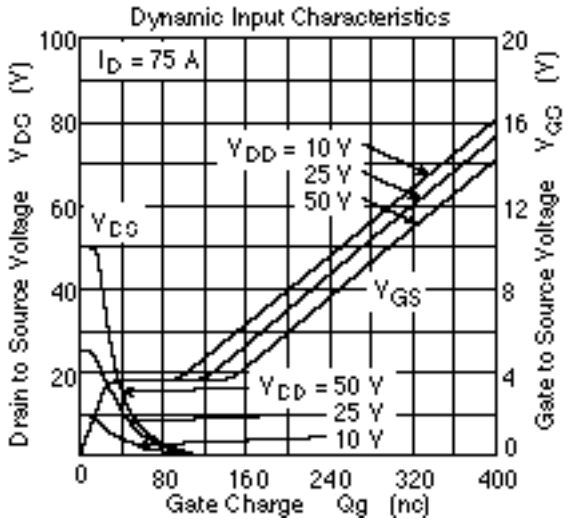


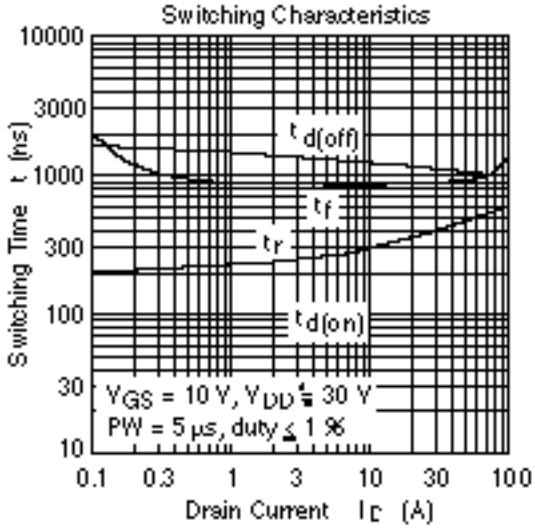
Forward Transfer Admittance vs. Drain Current

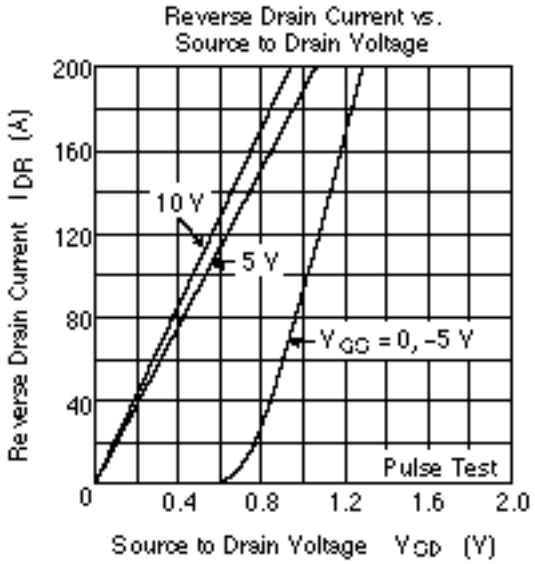


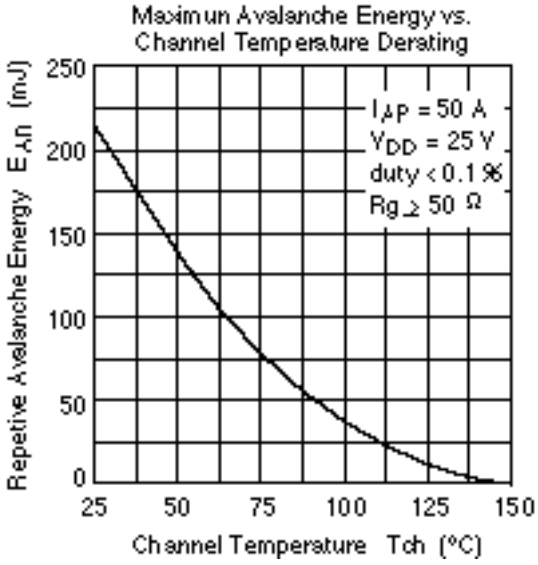

Body to Drain Diode Reverse Recovery Time
Reverse Recovery Time trr (ns)
500
200
100
50
20
10
5
di / dt = 50 A / µs
VGS = 0, Ta = 25 °C
0.1
0.3
1
3
10
30
100
Reverse Drain Current IDR (A)

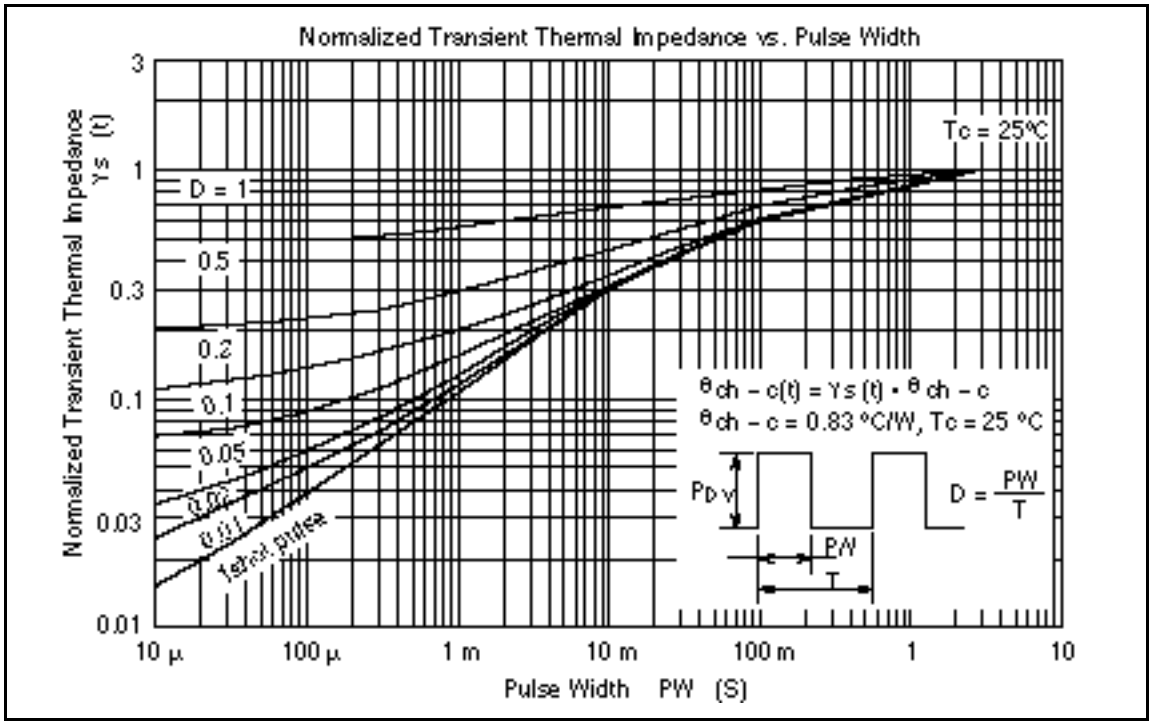

Typical Capacitance vs. Drain to Source Voltage
Capacitance C (pF)
30000
10000
3000
1000
300
100
Ciss
Coss
Crss
VGS = 0
f = 1 MHz
0
10
20
30
40
50
Drain to Source Voltage VDS (V)


Dynamic Input Characteristics
I_D = 75 A
V_{DD} = 10 V
25 V
50 V
V_{DS}
V_{GS}
V_{DD} = 50 V
25 V
10 V
Drain to Source Voltage V_{DS} (V)
Gate to Source Voltage V_{GS} (V)
Gate Charge Qg (nc)
0
80
160
240
320
400
100
80
60
40
20
20
16
12
8
4
0

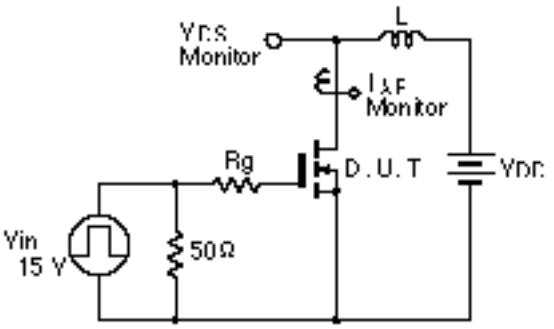

Switching Characteristics
$t_{d(off)}$
t_f
t_r
$t_{d(on)}$
V_{GS} = 10 V, V_{DD} ≒ 30 V
PW = 5 μs, duty ≦ 1 %
Switching Time t (ns)
Drain Current I_D (A)
10000
3000
1000
300
100
30
10
0.1
0.3
1
3
10
30
100


Reverse Drain Current vs.
Source to Drain Voltage
Reverse Drain Current I_{DR} (A)
200
160
120
80
40
0
10 V
5 V
V_{GS} = 0, −5 V
Pulse Test
0.4
0.8
1.2
1.6
2.0
Source to Drain Voltage V_{SD} (V)

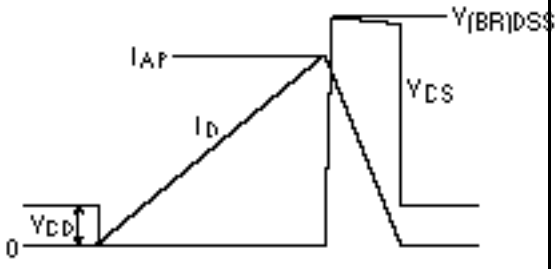

Maximun Avalanche Energy vs.
Channel Temperature Derating
Repetive Avalanche Energy E_{AR} (mJ)
250
200
150
100
50
0
I_{AP} = 50 A
V_{DD} = 25 V
duty < 0.1 %
Rg ≥ 50 Ω
25
50
75
100
125
150
Channel Temperature Tch (°C)


Normalized Transient Thermal Impedance vs. Pulse Width
Normalized Transient Thermal Impedance γs (t)
Tc = 25°C
D = 1
0.5
0.2
0.1
0.05
0.02
0.01
1shot pulse
θch – c(t) = γs (t) • θch – c
θch – c = 0.83 °C/W, Tc = 25 °C
PDM
D = PW/T
PW
T
3
1
0.3
0.1
0.03
0.01
10 µ
100 µ
1 m
10 m
100 m
1
10
Pulse Width PW (S)

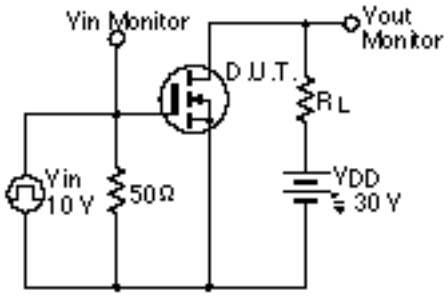
Avalanche Test Circuit and Waveform



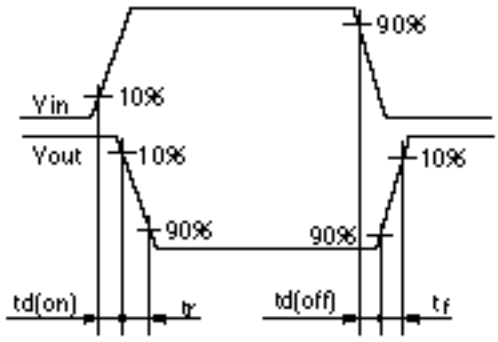
$$E_{AR} = \frac{1}{2} \cdot L \cdot I_{AP} \cdot \frac{V_{DSS}}{V_{DSS} - V_{DD}}$$



Switching Time Test Circuit



Waveform



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