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Renesas Technology Corp.
Customer Support Dept.
April 1, 2003

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Silicon N Channel Power MOS FET with Schottky Barrier Diode High Speed Power Switching



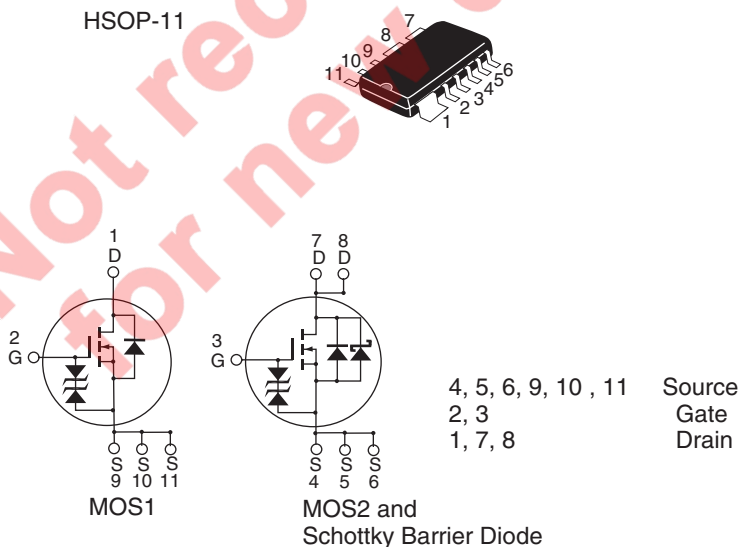
ADE-208-1576D (Z)

5th. Edition
Dec. 2002

Features

- Low on-resistance
- Capable of 4.5 V gate drive
- High density mounting
- Built-in Schottky Barrier Diode

Outline



Absolute Maximum Ratings

(Ta = 25°C)

Item	Symbol	Ratings		Unit
		MOS1	MOS2 & SBD	
Drain to source voltage	V_{DSS}	30	30	V
Gate to source voltage	V_{GSS}	±20	±12	V
Drain current	I_D	12	16	A
Drain peak current	$I_{D(pulse)}$ ^{Note1}	96	128	A
Reverse drain current	I_{DR}	12	16	A
Channel dissipation	P_{ch} ^{Note2}	2.0	3.5	W
Channel temperature	T_{ch}	150	150	°C
Storage temperature	T_{stg}	–55 to +150	–55 to +150	°C

Notes: 1. $PW \leq 10\mu s$, duty cycle $\leq 1\%$

2. 1 Drive operation; When using the glass epoxy board (FR4 40 x 40 x 1.6 mm), $PW \leq 10s$

Electrical Characteristics

(Ta = 25°C)

• MOS1

Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	30	—	—	V	$I_D = 10\text{mA}$, $V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	± 20	—	—	V	$I_G = \pm 100\mu\text{A}$, $V_{DS} = 0$
Gate to source leak current	I_{GSS}	—	—	± 10	μA	$V_{GS} = \pm 16\text{V}$, $V_{DS} = 0$
Zero gate voltage drain current	I_{DSS}	—	—	1	μA	$V_{DS} = 30\text{V}$, $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.0	—	2.5	V	$V_{DS} = 10\text{V}$, $I_D = 1\text{mA}$
Static drain to source on state	$R_{DS(on)}$	—	10	13	$\text{m}\Omega$	$I_D = 6\text{A}$, $V_{GS} = 10\text{V}$ ^{Note3}
resistance	$R_{DS(on)}$	—	18	27	$\text{m}\Omega$	$I_D = 6\text{A}$, $V_{GS} = 4.5\text{V}$ ^{Note3}
Forward transfer admittance	$ y_{fs} $	12	20	—	S	$I_D = 6\text{A}$, $V_{DS} = 10\text{V}$ ^{Note3}
Input capacitance	C_{iss}	—	1000	—	pF	$V_{DS} = 10\text{V}$
Output capacitance	C_{oss}	—	280	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	C_{rss}	—	160	—	pF	$f = 1\text{MHz}$
Total gate charge	Q_g	—	9	—	nc	$V_{DD} = 10\text{V}$
Gate to source charge	Q_{gs}	—	3.6	—	nc	$V_{GS} = 5\text{V}$
Gate to drain charge	Q_{gd}	—	3.2	—	nc	$I_D = 16\text{A}$
Turn-on delay time	$t_{d(on)}$	—	12	—	ns	$V_{GS} = 10\text{V}$, $I_D = 6\text{A}$
Rise time	t_r	—	22	—	ns	$V_{DD} \approx 10\text{V}$
Turn-off delay time	$t_{d(off)}$	—	55	—	ns	$R_L = 1.67\Omega$
Fall time	t_f	—	9	—	ns	$R_g = 4.7\Omega$
Body-drain diode forward voltage	V_{DF}	—	0.82	1.07	V	$I_F = 12\text{A}$, $V_{GS} = 0$ ^{Note3}
Body-drain diode reverse recovery time	t_{rr}	—	25	—	ns	$I_F = 12\text{A}$, $V_{GS} = 0$ $diF/dt = 50\text{A}/\mu\text{s}$

Notes: 3. Pulse test

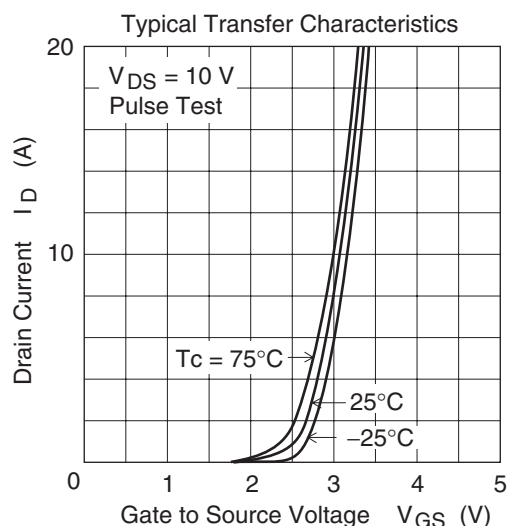
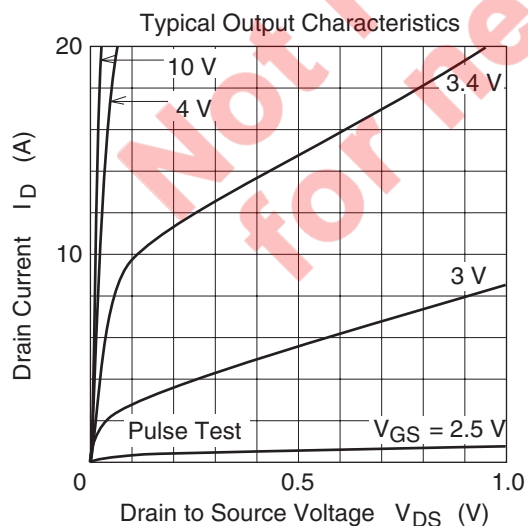
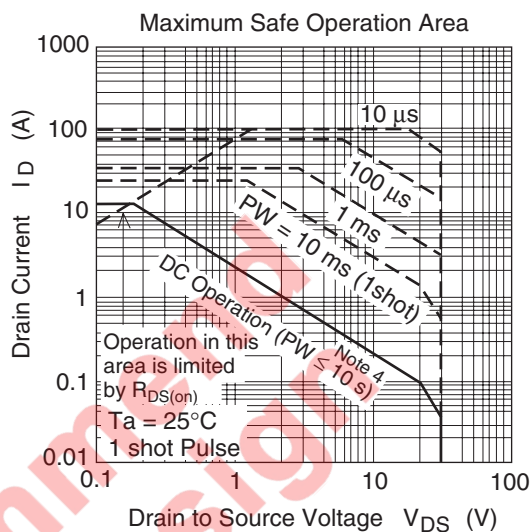
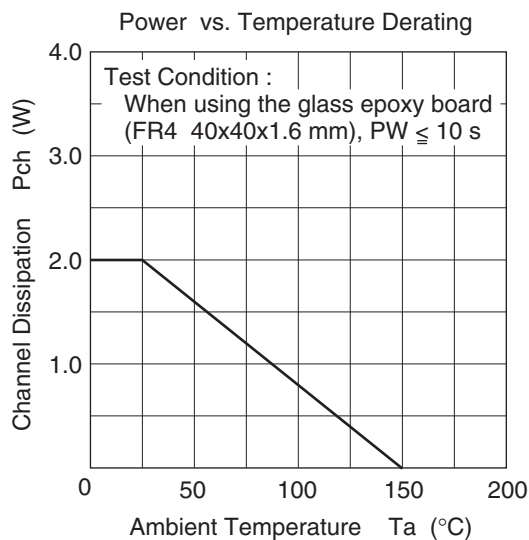
• MOS2 & Schottky Barrier Diode

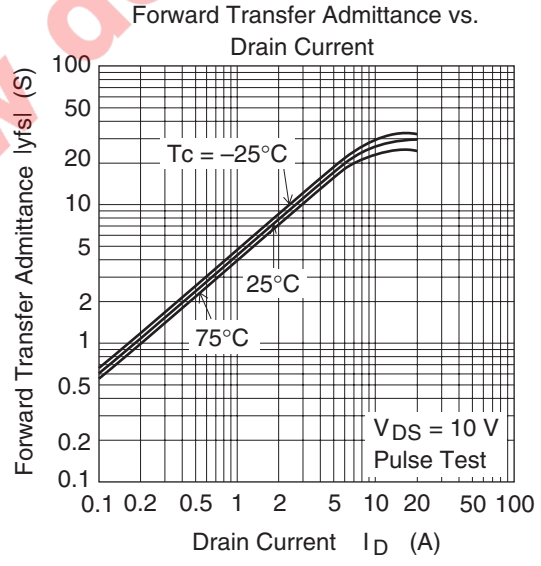
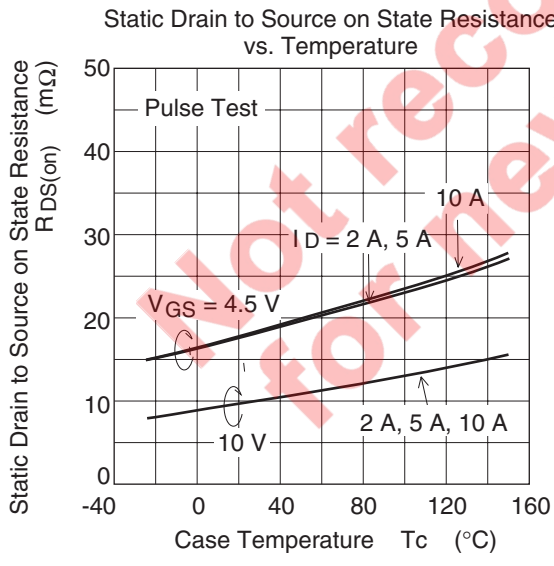
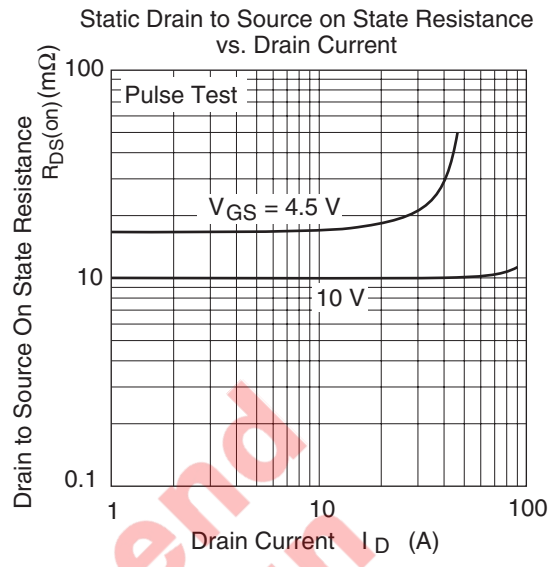
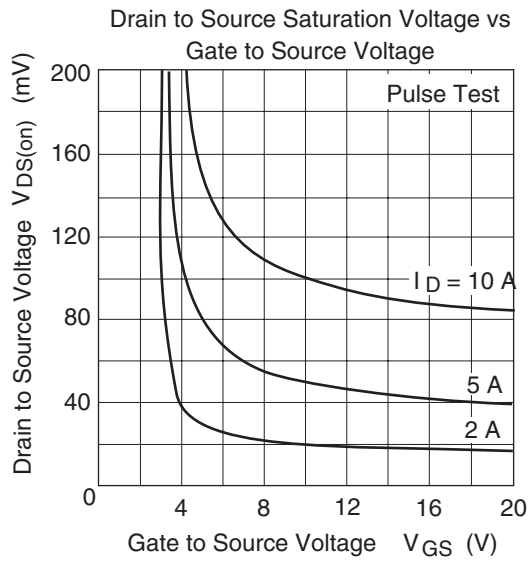
Item	Symbol	Min	Typ	Max	Unit	Test Conditions
Drain to source breakdown voltage	$V_{(BR)DSS}$	30	—	—	V	$I_D = 10\text{mA}$, $V_{GS} = 0$
Gate to source breakdown voltage	$V_{(BR)GSS}$	± 12	—	—	V	$I_G = \pm 100\mu\text{A}$, $V_{DS} = 0$
Gate to source leak current	I_{GSS}	—	—	± 10	μA	$V_{GS} = \pm 10\text{V}$, $V_{DS} = 0$
Zero gate voltage drain current	I_{DSS}	—	—	1	m A	$V_{DS} = 30\text{V}$, $V_{GS} = 0$
Gate to source cutoff voltage	$V_{GS(off)}$	1.4	—	2.5	V	$V_{DS} = 10\text{V}$, $I_D = 1\text{mA}$
Static drain to source on state resistance	$R_{DS(on)}$	—	5.6	7.3	m Ω	$I_D = 8\text{A}$, $V_{GS} = 10\text{V}$ ^{Note3}
	$R_{DS(on)}$	—	7.3	9.5	m Ω	$I_D = 8\text{A}$, $V_{GS} = 4.5\text{V}$ ^{Note3}
Forward transfer admittance	$ y_{fs} $	25	41	—	S	$I_D = 8\text{A}$, $V_{DS} = 10\text{V}$ ^{Note3}
Input capacitance	Ciss	—	3800	—	pF	$V_{DS} = 10\text{V}$
Output capacitance	Coss	—	745	—	pF	$V_{GS} = 0$
Reverse transfer capacitance	Crss	—	300	—	pF	$f = 1\text{MHz}$
Total gate charge	Qg	—	34	—	nc	$V_{DD} = 10\text{V}$
Gate to source charge	Qgs	—	10	—	nc	$V_{GS} = 5\text{V}$
Gate to drain charge	Qgd	—	8	—	nc	$I_D = 16\text{A}$
Turn-on delay time	$t_{d(on)}$	—	18	—	ns	$V_{GS} = 10\text{V}$, $I_D = 8\text{A}$
Rise time	t_r	—	22	—	ns	$V_{DD} \approx 10\text{V}$
Turn-off delay time	$t_{d(off)}$	—	88	—	ns	$R_L = 1.25\Omega$
Fall time	t_f	—	9.0	—	ns	$R_g = 4.7\Omega$
Schottky Barrier diode forward voltage	V_F	—	0.5	—	V	$I_F = 3.5\text{A}$, $V_{GS} = 0$ ^{Note3}
Body-drain diode reverse recovery time	t_{rr}	—	35	—	ns	$I_F = 16\text{A}$, $V_{GS} = 0$ $diF/dt = 50\text{A}/\mu\text{s}$

Notes: 3. Pulse test

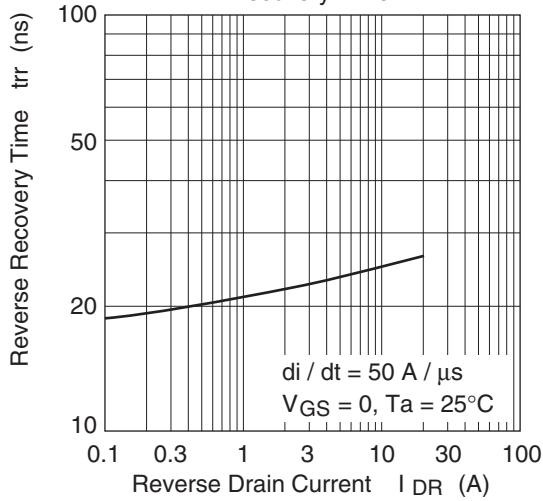
Main Characteristics

• MOS1

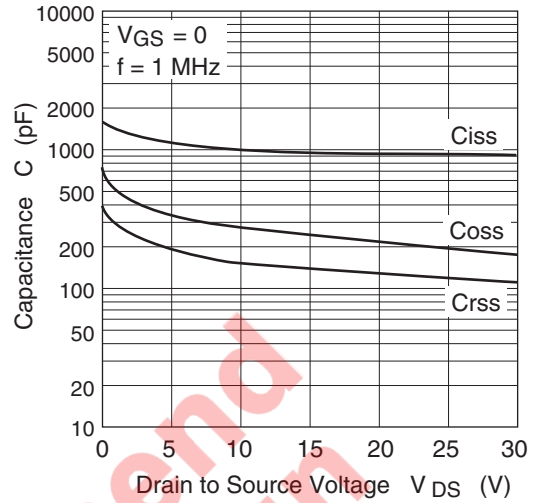




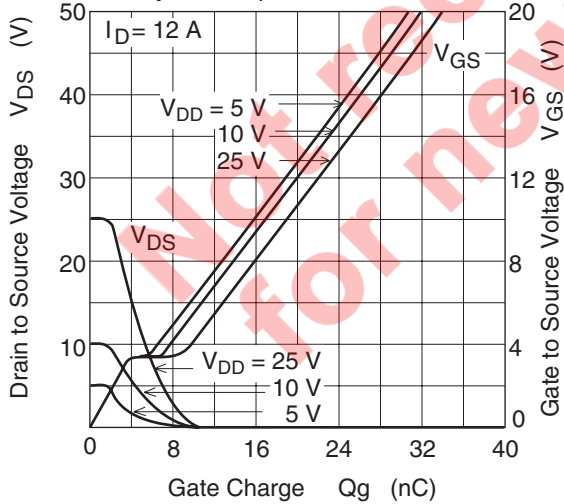
Body-Drain Diode Reverse Recovery Time



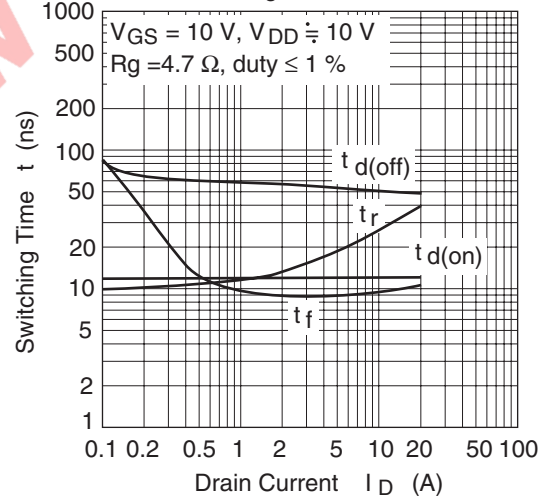
Typical Capacitance vs. Drain to Source Voltage

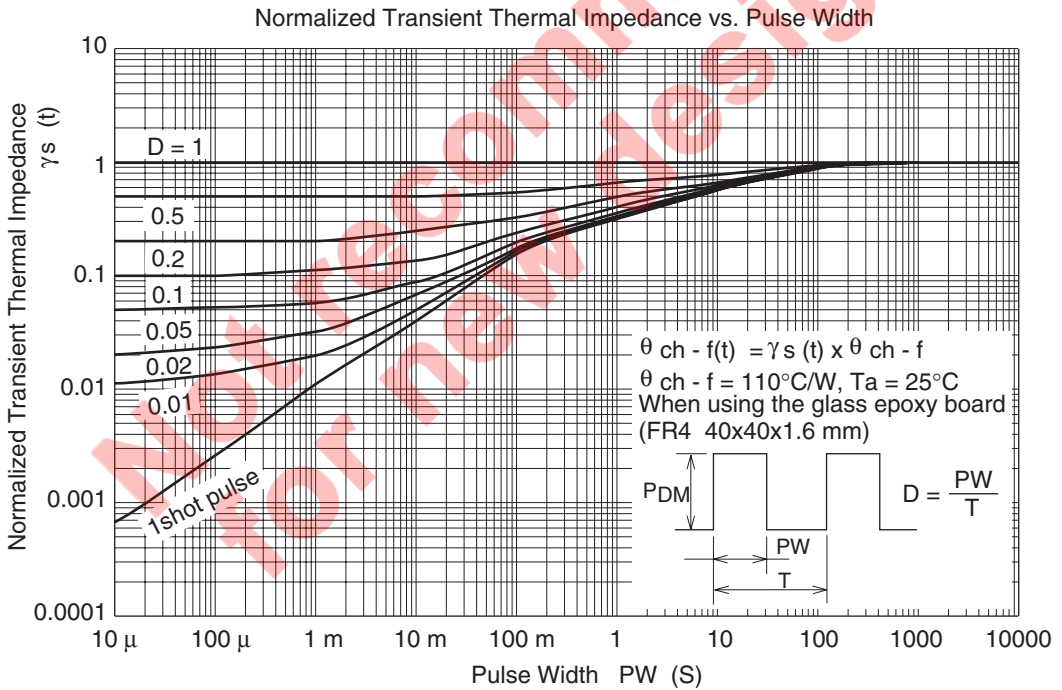
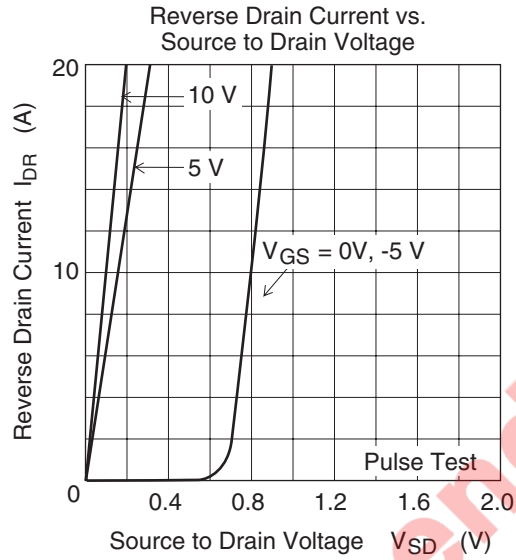


Dynamic Input Characteristics

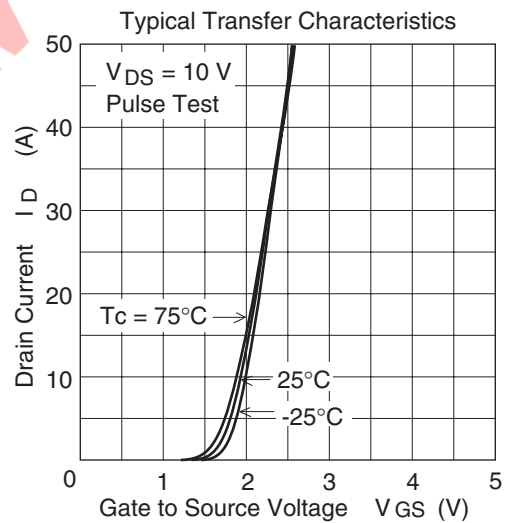
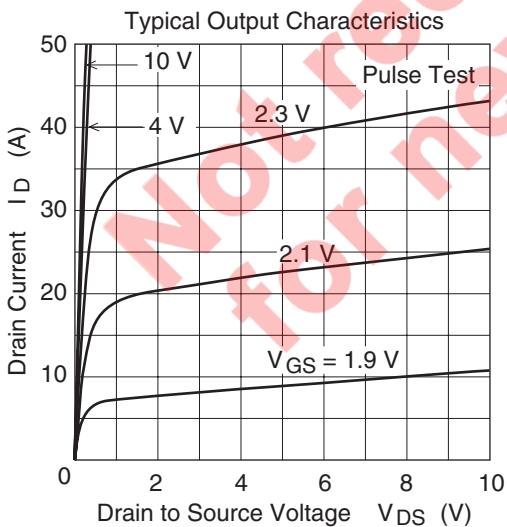
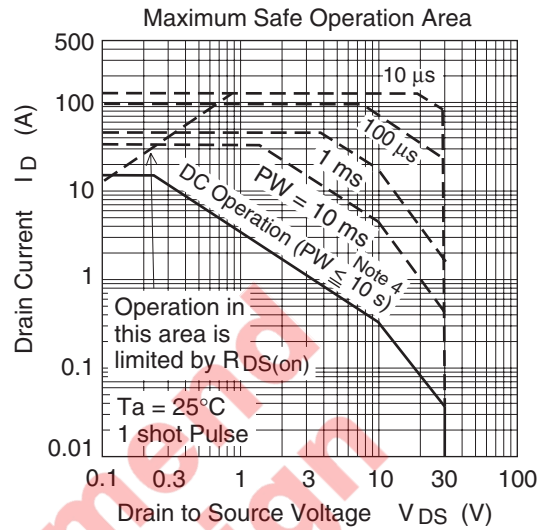
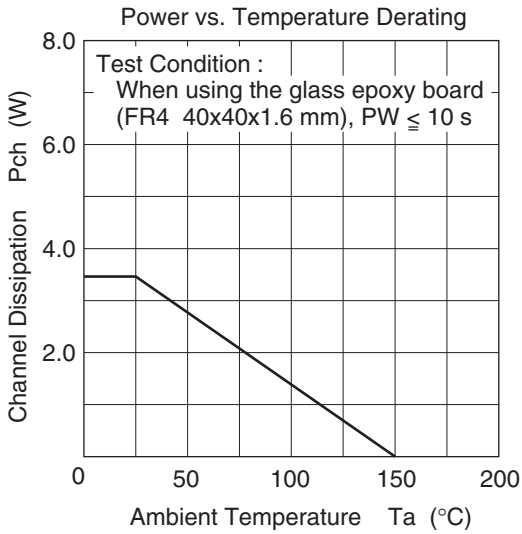


Switching Characteristics

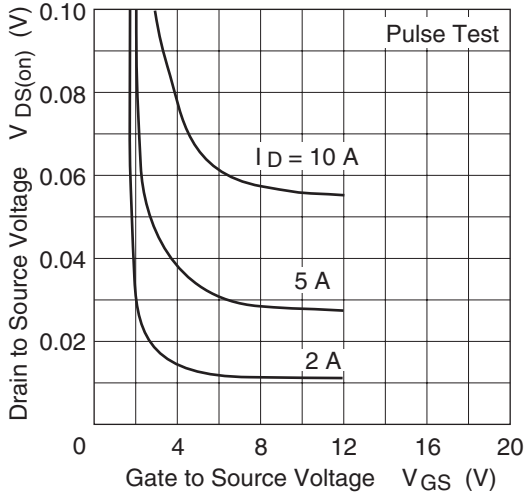




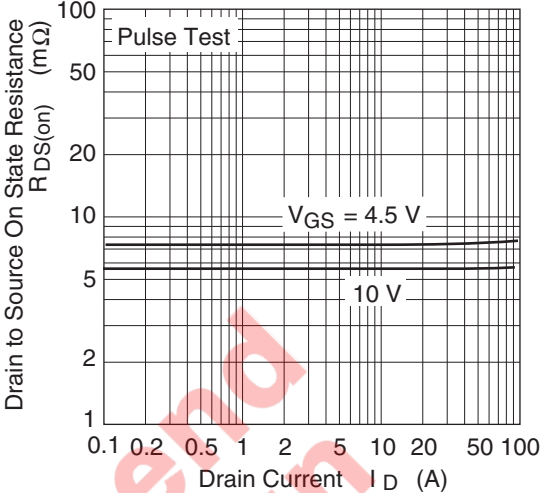
• MOS2 & Schottky Barrier Diode



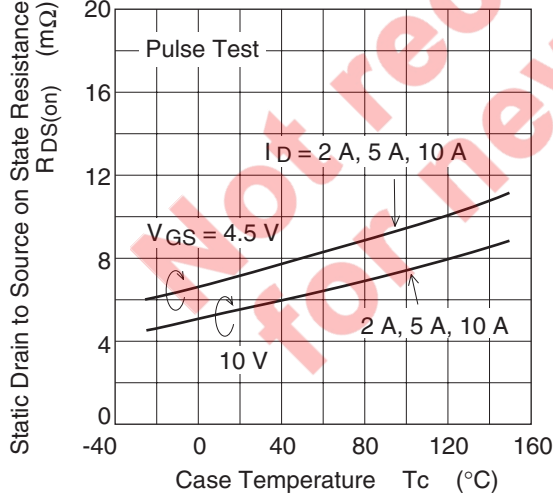
Drain to Source Saturation Voltage vs.
Gate to Source Voltage



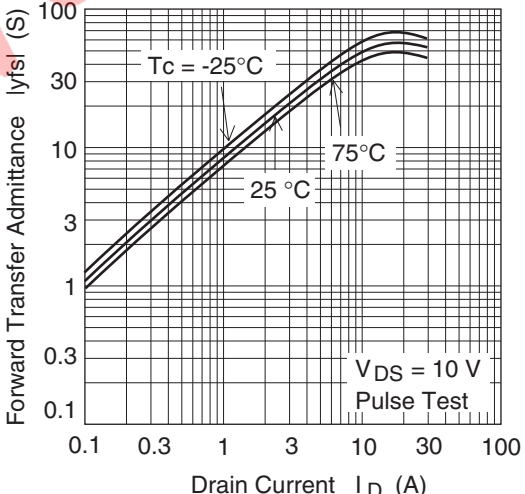
Static Drain to Source on State Resistance
vs. Drain Current



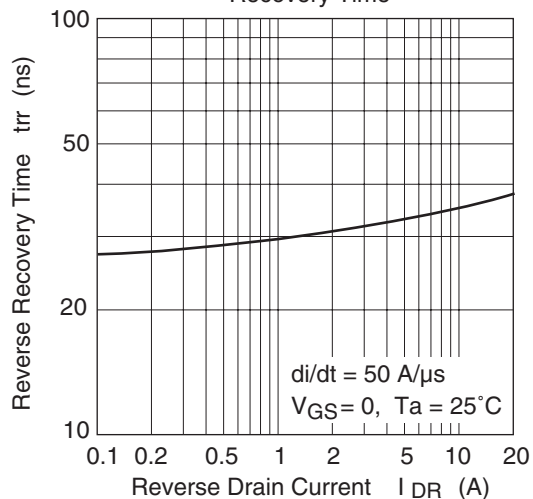
Static Drain to Source on State Resistance
vs. Temperature



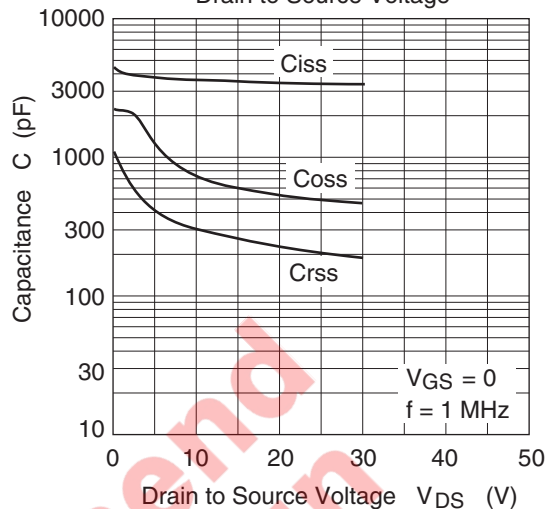
Forward Transfer Admittance vs.
Drain Current



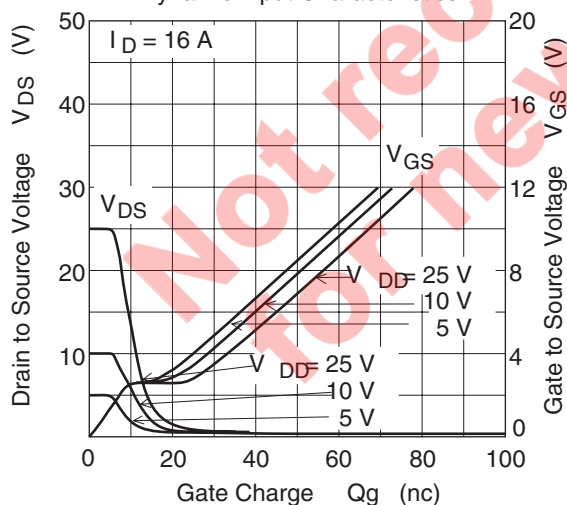
Body - Drain Diode Reverse Recovery Time



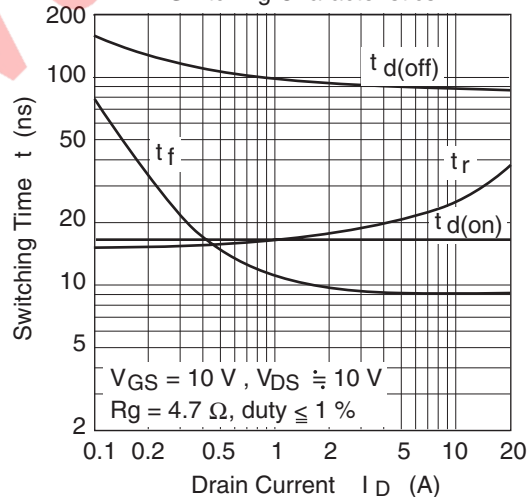
Typical Capacitance vs. Drain to Source Voltage

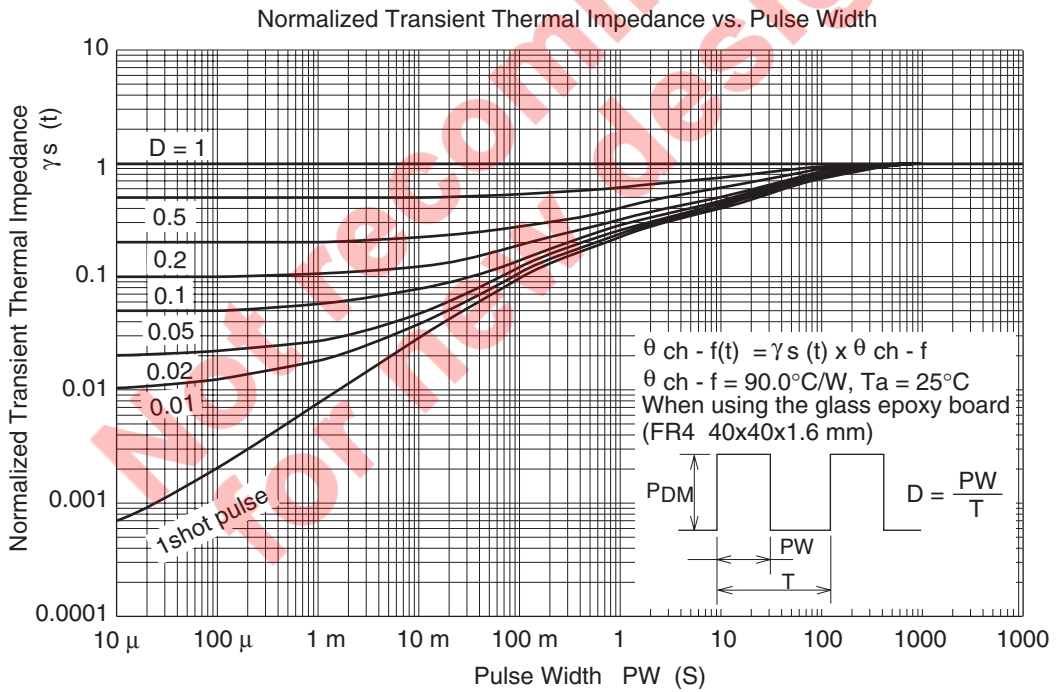
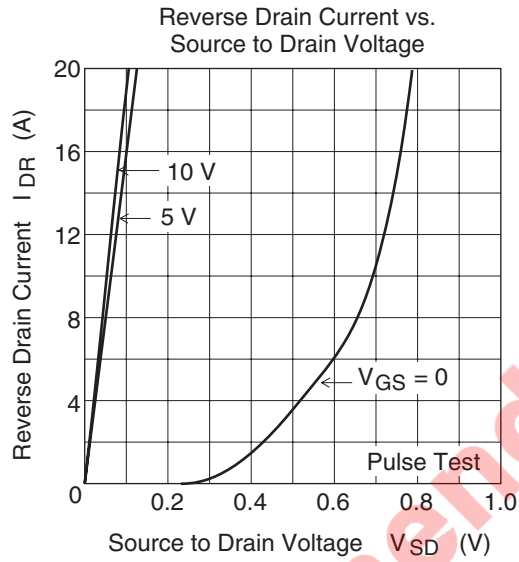


Dynamic Input Characteristics

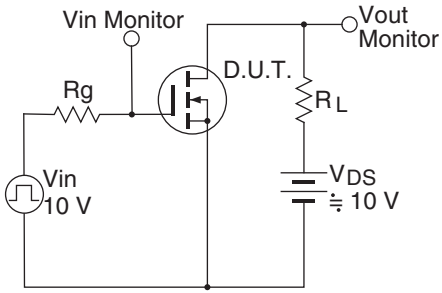


Switching Characteristics

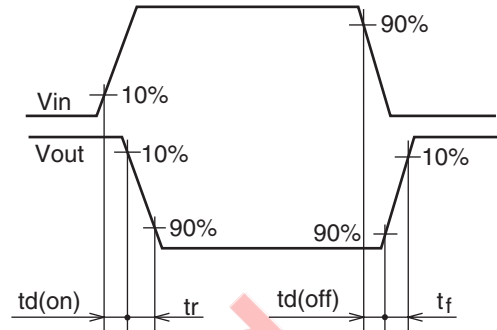




Switching Time Test Circuit

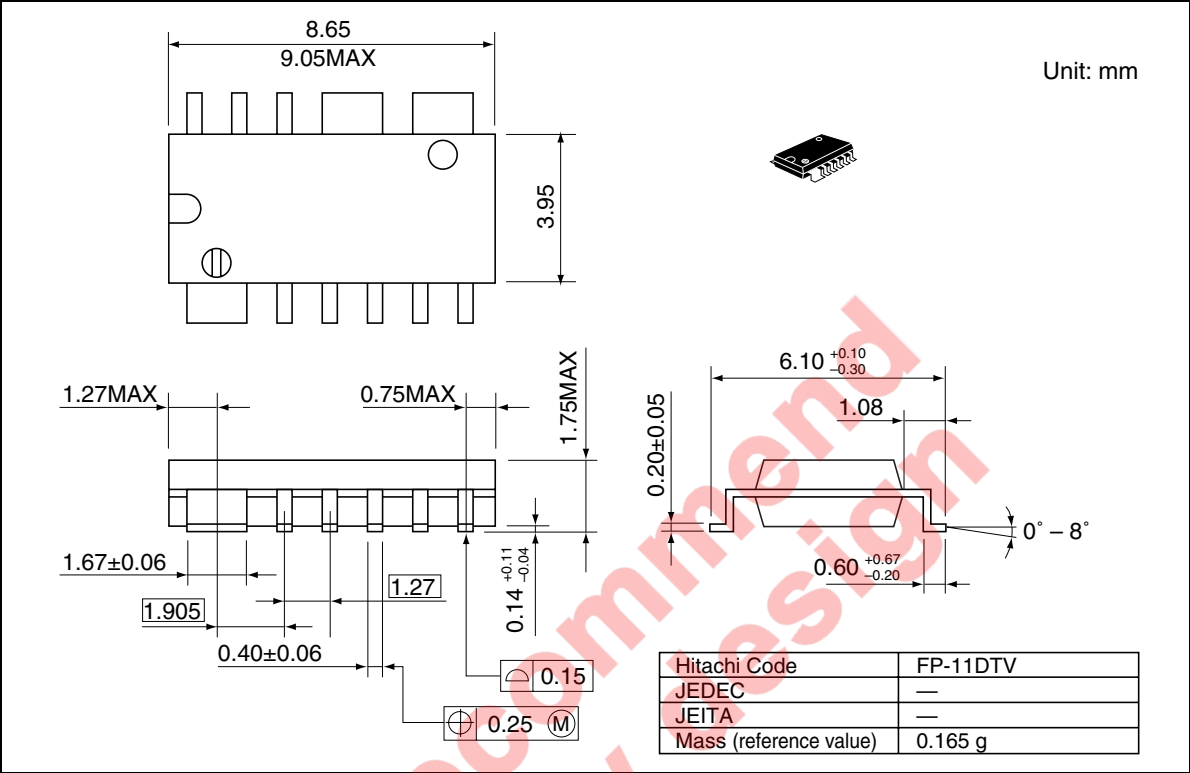


Switching Time Waveform



Not recommended
for new design

Package Dimensions



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