2SK2166-01R

N-CHANNEL SILICON POWER MOSFET
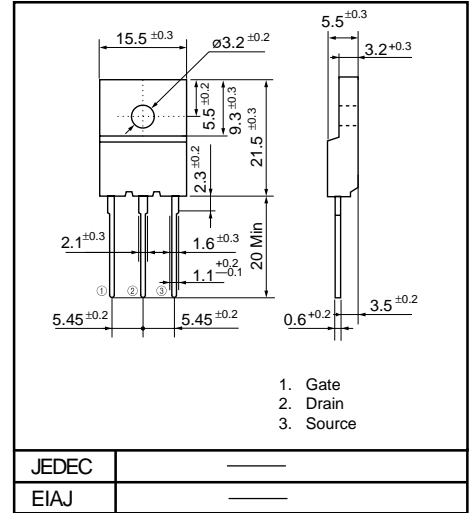
FAP-IIIA SERIES

■ Features

● **High current**

● **Low on-resistance**

● **No secondary breakdown**

● **Low driving power**

● **High forward Transconductance**

● **Avalanche-proof**

● **Including G-S Zener diode**

■ Applications

● **Motor controllers**

● **General purpose power amplifier**

● **DC-DC converters**

■ Outline Drawings

1. Gate
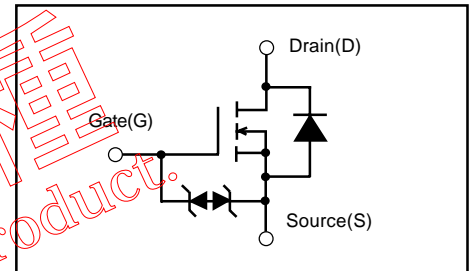2. Drain
3. Source

JEDEC	———
EIAJ	———

■Maximum ratings and characteristics

● **Absolute maximum ratings (Tc=25°C unless otherwise specified)**

Item	Symbol	Rating	Unit
Drain-source voltage	V_{DS}	60	V
Continuous drain current	I_D	40	A
Pulsed drain current	$I_{D(puls)}$	160	A
Continuous reverse drain current	I_{DR}	40	A
Gate-source peak voltage	V_{GS}	±20	V
Max. power dissipation	P_D	80	W
Operating and storage temperature range	T_{ch}	+150	℃
	T_{stg}	-55 to +150	℃

■ Equivalent circuit schematic

● **Electrical characteristics (Tc =25°C unless otherwise specified)**

Item	Symbol	Test Conditions		Min.	Typ.	Max.	Units
Drain-source breakdown voltage	$V_{(BR)DSS}$	I_D=1mA V_{GS}=0V		60			V
Gate threshold voltage	$V_{GS(th)}$	I_D=1mA V_{DS}=V_{GS}		1.0	1.5	2.5	V
Zero gate voltage drain current	I_{DSS}	V_{DS}=60V V_{GS}=0V	T_{ch}=25°C			500	μA
			T_{ch}=125°C			1.0	mA
Gate-source leakage current	I_{GSS}	V_{GS}=±16V V_{DS}=0V				10	μA
Drain-source on-state resistance	$R_{DS(on)}$	I_D=20A	V_{GS}=4V		0.03	0.05	Ω
			V_{GS}=10V		0.02	0.03	
Forward transconductance	g_{fs}	I_D=20A V_{DS}=25V		13	25		S
Input capacitance	C_{iss}	V_{DS}=25V			1600	2400	pF
Output capacitance	C_{oss}	V_{GS}=0V			580	870	
Reverse transfer capacitance	C_{rss}	f=1MHz			320	480	
Turn-on time t_{on}	$t_{d(on)}$	V_{CC}=30V R_G=25 Ω			15	23	ns
(t_{on}=$t_{d(on)}$+t_r)	t_r	I_D=40A			90	140	
Turn-off time t_{off}	$t_{d(off)}$	V_{GS}=10V			300	450	
(t_{off}=$t_{d(off)}$+t_f)	t_f				190	290	
Avalanche capability	I_{AV}	L=100μH T_{ch}=25°C		40			A
Diode forward on-voltage	V_{SD}	I_F=2xI_{DR} V_{GS}=0V T_{ch}=25°C			1.40		V
Reverse recovery time	t_{rr}	I_F=I_{DR} V_{GS}=0V			80		ns
Reverse recovery charge	Q_{rr}	-di/dt=100A/μs T_{ch}=25°C			0.17		μC

● **Thermal characteristics**

Item	Symbol	Test Conditions	Min.	Typ.	Max.	Units
Thermal resistance	$R_{th(ch-a)}$	channel to ambient			30.0	℃/W
	$R_{th(ch-c)}$	channel to case			1.56	℃/W

1

■ Characteristics

Typical output characteristics

$I_D = f(V_{DS}) : 80 \mu s$ pulse test. $T_{ch} = 25°C$

$V_{GS} = 20 V$
10 V
8.0 V
5.0 V
4.5 V
4.0 V
3.5 V
3.0 V

I_D [A] vs V_{DS} [V]

On state resistance vs. T_ch

$R_{DS(on)} = f(T_{ch}) : I_D = 20 A, V_{GS} = 10 V$

max.
typ.

$R_{DS(on)}$ [mΩ] vs T_{ch} [°C]
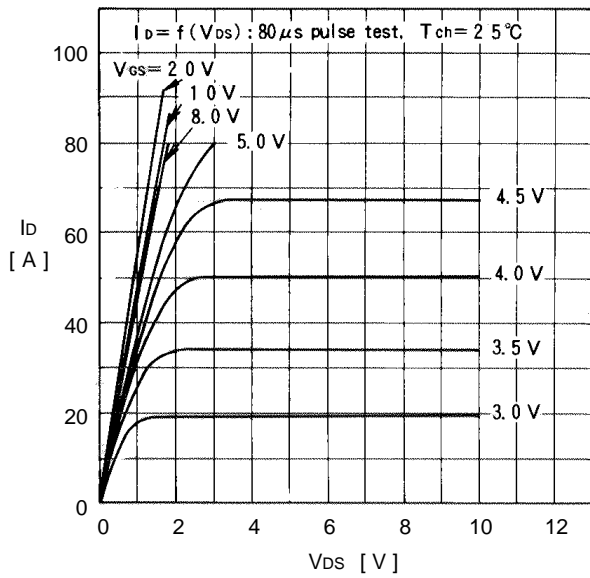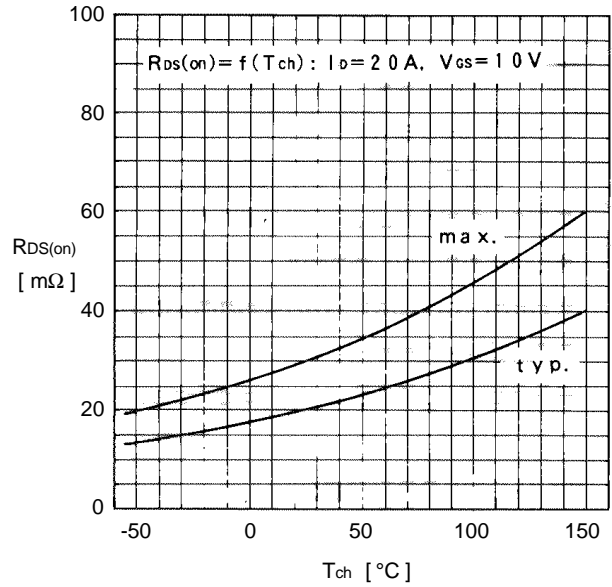
Typical transfer characteristics

$I_D = f(V_{GS}) : 80 \mu s$ pulse test.
$V_{DS} = 25 V$ $T_{ch} = 25°C$

I_D [A] vs V_{GS} [V]
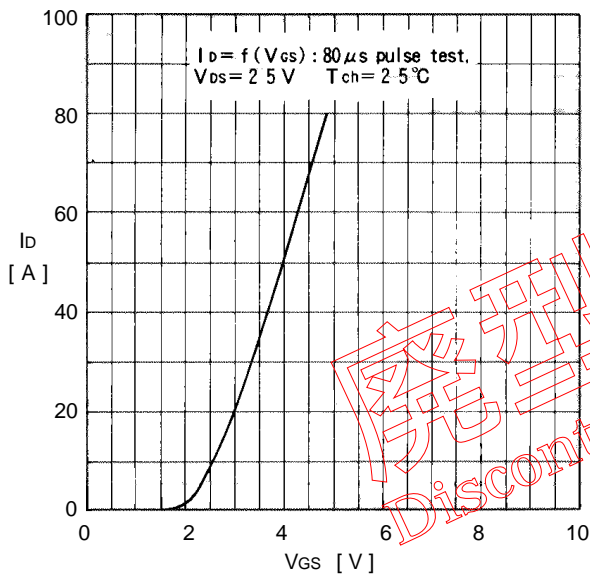
Typical Drain-Source on state resistance vs. I_D

$R_{DS(on)} = f(I_D) : 80 \mu s$ pulse test. $T_{ch} = 25°C$

$V_{GS} = 3.0 V$ 3.5 V 4.0 V 4.5 V
5.0 V
8.0 V
10 V
20 V

$R_{DS(on)}$ [mΩ] vs I_D [A]
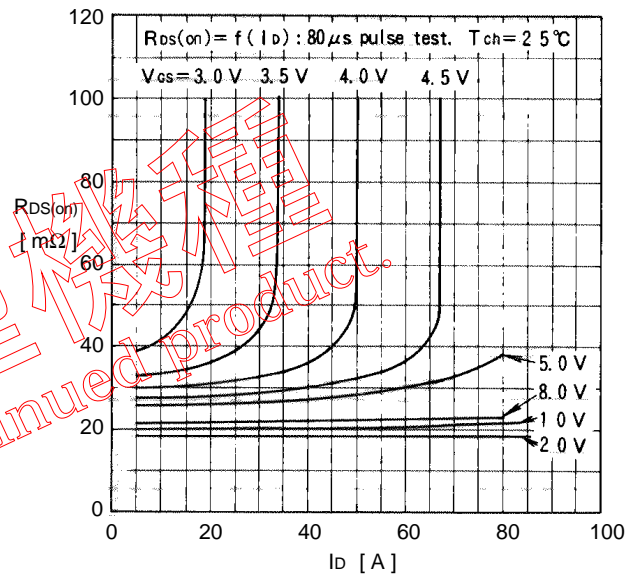
Typical forward transconductance vs. I_D

$gfs = f(I_D) : 80 \mu s$ pulse test.
$V_{DS} = 25 V$ $T_{ch} = 25°C$

gfs [S] vs I_D [A]

Gate threshold voltage vs. T_ch

$V_{GS(th)} = f(T_{ch}) : V_{DS} = V_{GS}, I_D = 1 mA$

max.
typ.
min.

$V_{GS(th)}$ [V] vs T_{ch} [°C]
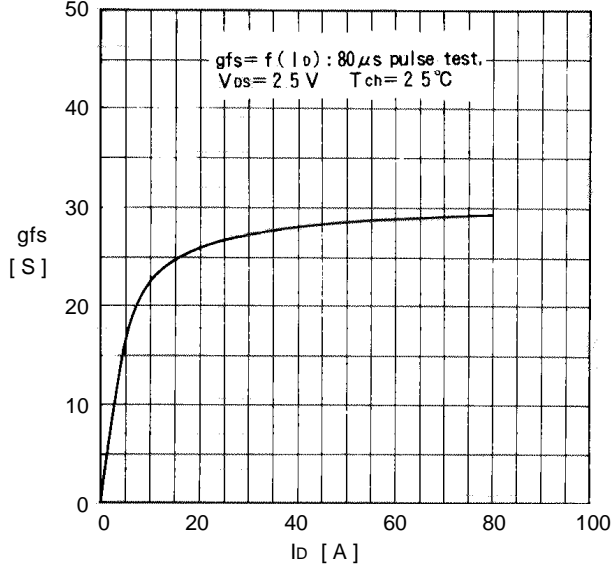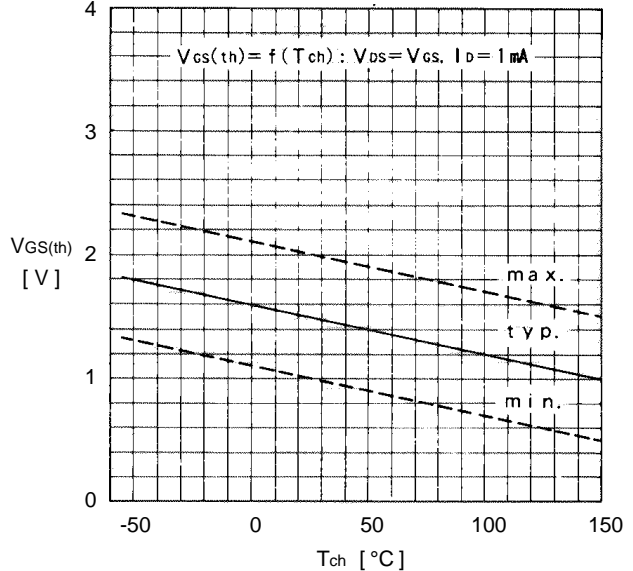
Typical capacitance vs. V_DS

$C = f(V_{DS}) : V_{GS} = 0 V, f = 1 MHz$

Ciss
Coss
Crss

Typical input charge

$V_{GS} = f(Qg) : I_D = 40 A$

V_DS
V_GS

$V_{CC} =$
48 V
30 V
12 V

$V_{CC} =$
48 V
30 V
12 V
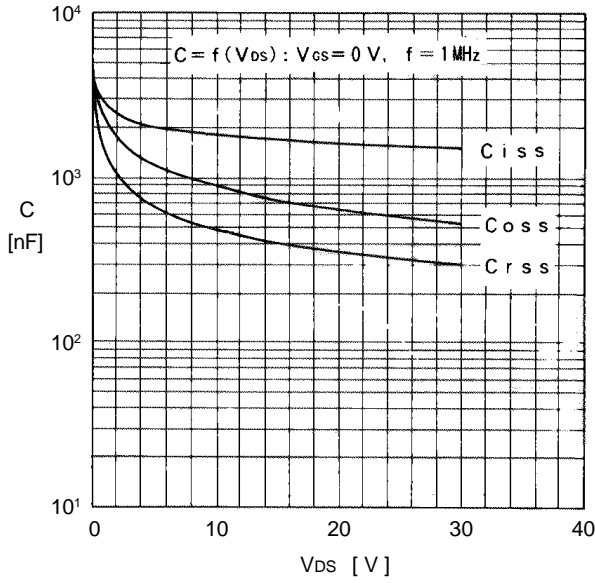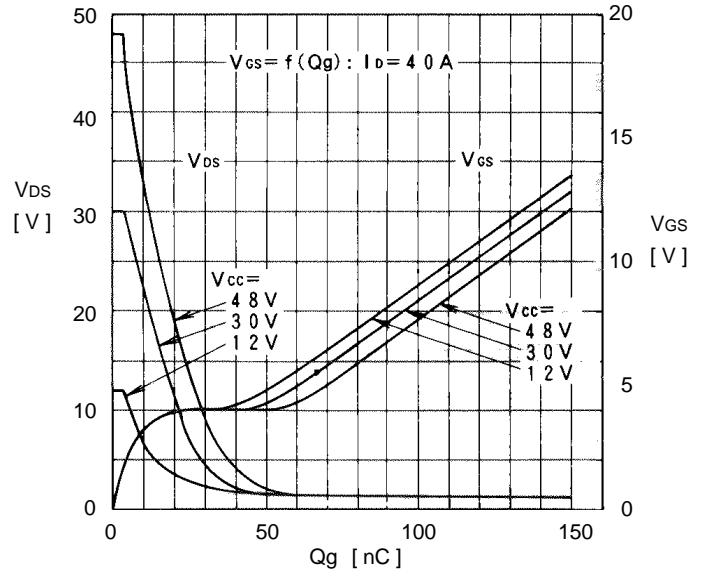
Forward characteristics of reverse diode

$I_F = f(V_{SD}) : 80 \mu s$ pulse test. $T_{ch} = 25 ℃$
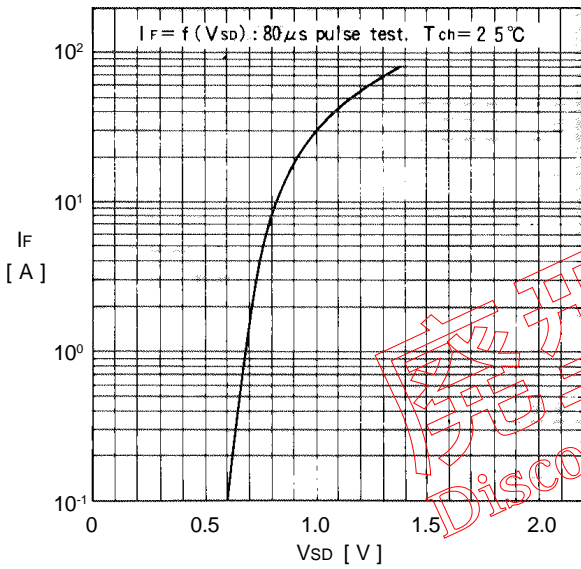
Allowable power dissipation vs. T_C

$P_D = f(T_C)$
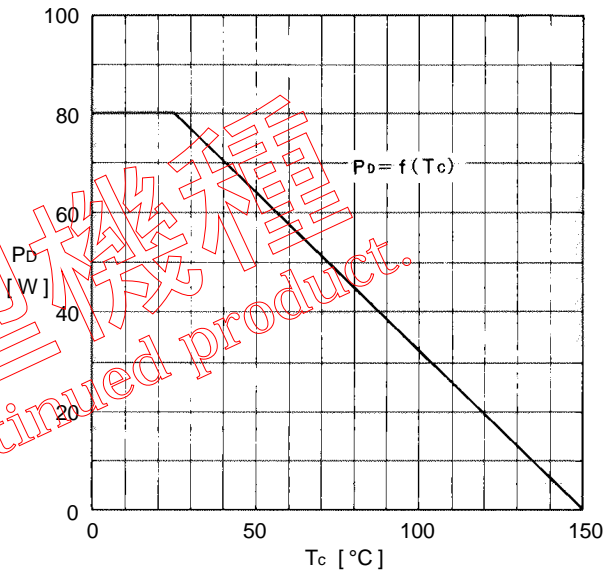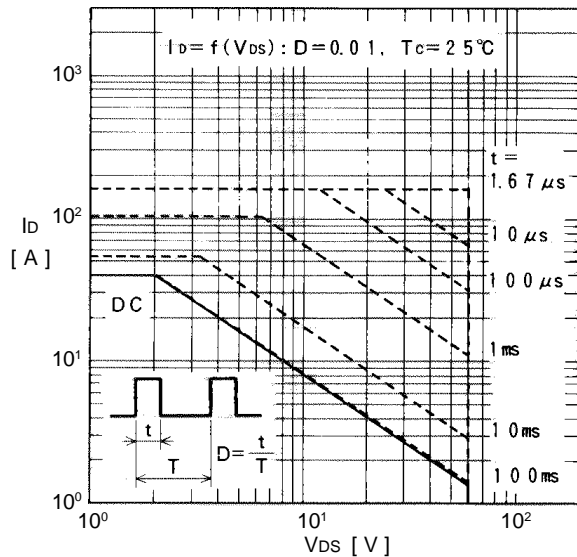
Transient thermal impedance

D = 0.5
0.2
0.1
0.05
0.02
0.01
0

$D = \dfrac{t}{T}$

Safe operating area

$I_D = f(V_{DS}) : D = 0.01, T_C = 25℃$

t =
1.67 μs
10 μs
100 μs
1 ms
10 ms
100 ms

DC

$D = \dfrac{t}{T}$

3