SANKEN ELECTRIC

F L D 4 7 0

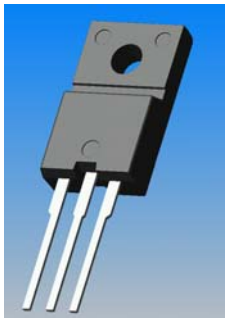
Nov. 2010

Features

N channel 40V MOSFET for automotive application
TO220F: wide pin package (for high current)

Package

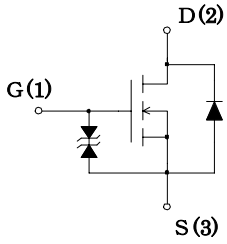
FM20 (TO220 Full Mold)



Applications

Automotive: EPS motor driver application
Automotive: Other motor driver and solenoid driver application

Internal Equivalent Circuit



Key Specifications

Absolute maximum ratings

(Ta=25°C)

Characteristic	Symbol	Rating	Unit
Drain to Source Voltage	V_{DSS}	40	V
Gate to Source Voltage	V_{GSS}	±20	V
Continuous Drain Current	I_D	±70	A
Pulsed Drain Current	$I_{D(pulse)}$ ※1	±140	A
Maximum Power Dissipation	P_D	35 （Tc=25℃）	W
Single Pulse Avalanche Energy	E_{AS} ※2	400	mJ
Avalanche Current	I_{AS}	25	A
Maximum Drain to Source dv/dt 1	dv/dt 1※2	0.3	V/ns
Peak diode recovery dv/dt 2	dv/dt 2※3	1.0	V/ns
Peak diode recovery di/dt	di/dt※3	100	A/μs
Channel Temperature	Tch	150	℃
Storage Temperature	Tstg	-55～150	℃

※1 PW≦100μsec. duty cycle≦1%
※2 V_{DD}=20V, L=1mH, I_L=20A, unclamped, Rg＝50Ω, See Fig.1
※3 I_{SD}=25A, See Fig.2

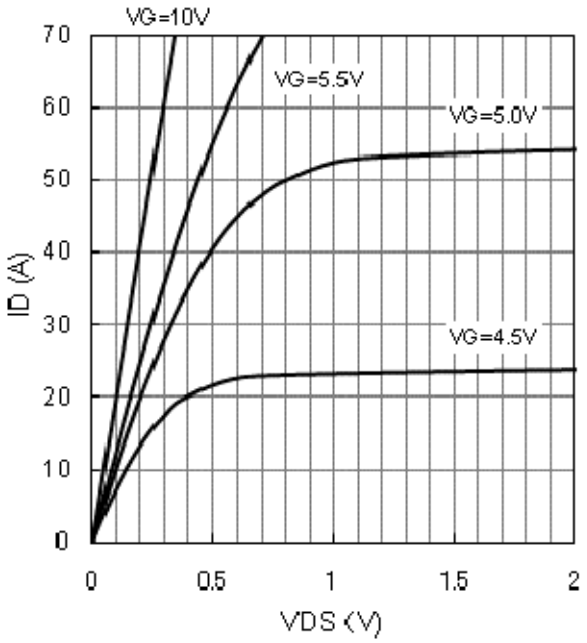
Electrical characteristics

(Ta=25°C)

Characteristic	Symbol	Test Conditions	Limits			Unit
			MIN	TYP	MAX	
Drain to Source breakdown Voltage	$V_{(BR)DSS}$	I_D=100μA,V_{GS}=0V	40			V
Gate to Source Leakage Current	I_{GSS}	V_{GS}=±15V			±2	μA
Drain to Source Leakage Current	I_{DSS}	V_{DS}=40V, V_{GS}=0V			100	μA
Gate Threshold Voltage	V_{TH}	V_{DS}=10V, I_D=1mA	2.0	3.0	4.0	V
Forward Transconductance	Re(yfs)	V_{DS}=10V, I_D=35A	30	50		S
Static Drain to Source On-Resistance	$R_{DS(ON)}$	I_D=35A, V_{GS}=10V		5.0	6.0	mΩ
Input Capacitance	Ciss	V_{DS}=10V V_{GS}=0V f=1MHz		5100		pF
Output Capacitance	Coss			1200		
Reverse Transfer Capacitance	Crss			860		
Turn-On Delay Time	td(on)	I_D=35A, V_{DD}≒20V R_G=22Ω,R_{GS}=50Ω R_L=0.57Ω, V_{GS}=10V See Fig.3		100		ns
Rise Time	tr			100		
Turn-Off Delay Time	td(off)			300		
Fall Time	tf			130		
Source-Drain Diode Forward Voltage	V_{SD}	I_{SD}=50A,V_{GS}=0V		0.9	1.2	V
Source-Drain Diode Reverse Recovery Time	trr	I_{SD}=25A di/dt=50A/us		100		ns
Thermal Resistance Junction to Case	Rth(ch-c)				3.57	℃/W
Thermal Resistance Junction to Ambient	Rth(ch-a)				62.5	℃/W

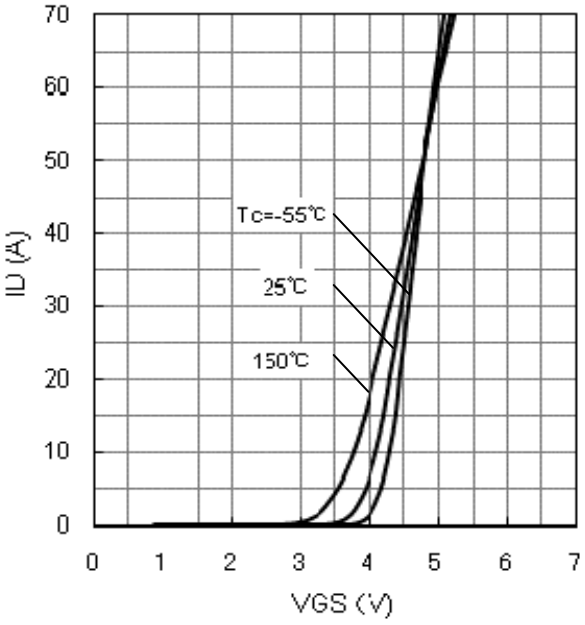
Characteristic Curves (Tc=25℃)

ID - VDS characteristics (typical)



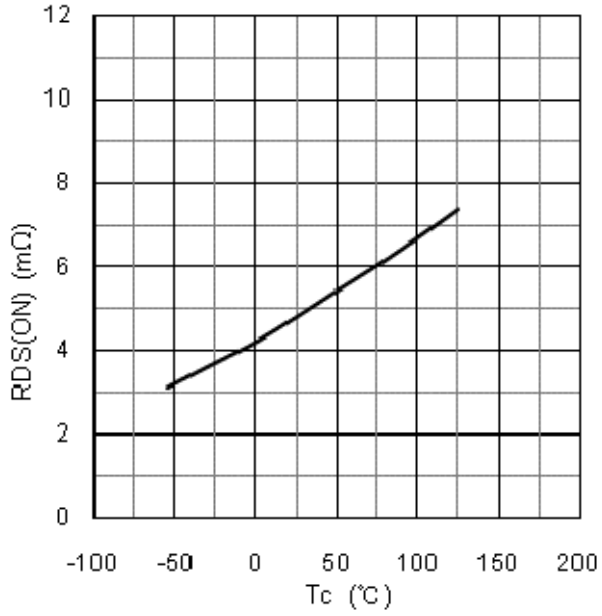
ID - VGS characteristics (typical)

VDS=10V



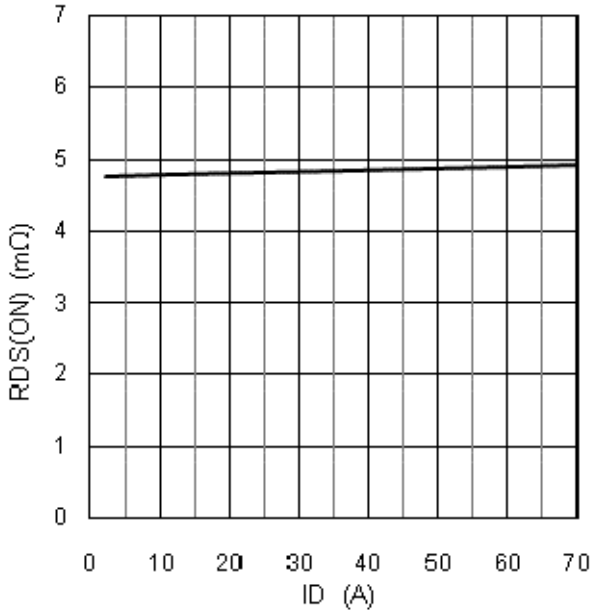
RDS(ON) - Tc characteristics (typical)

VGS=10V



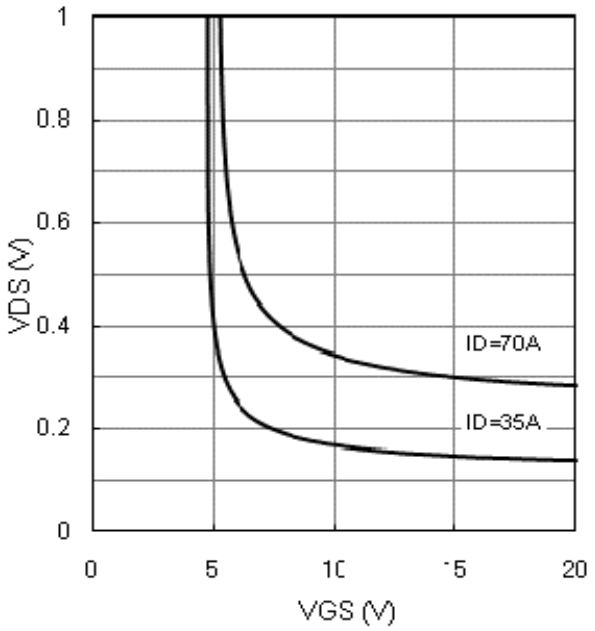
RDS(ON) - ID characteristics (typical)

VGS=10V



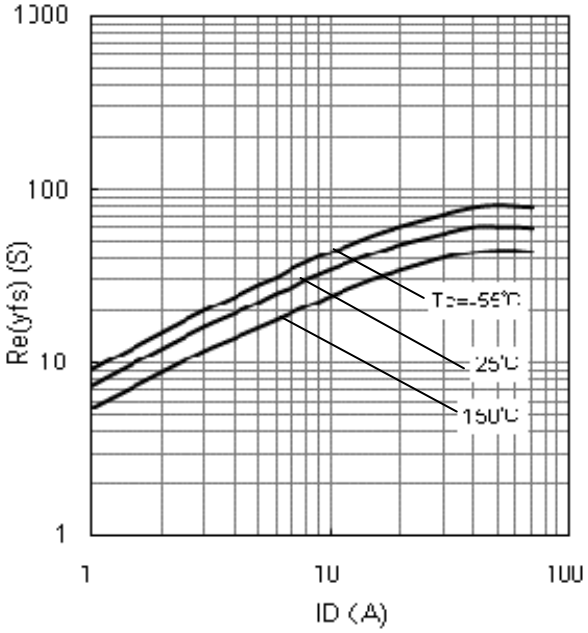
Characteristic Curves (Tc=25℃)

VDS - VGS characteristics (typica)



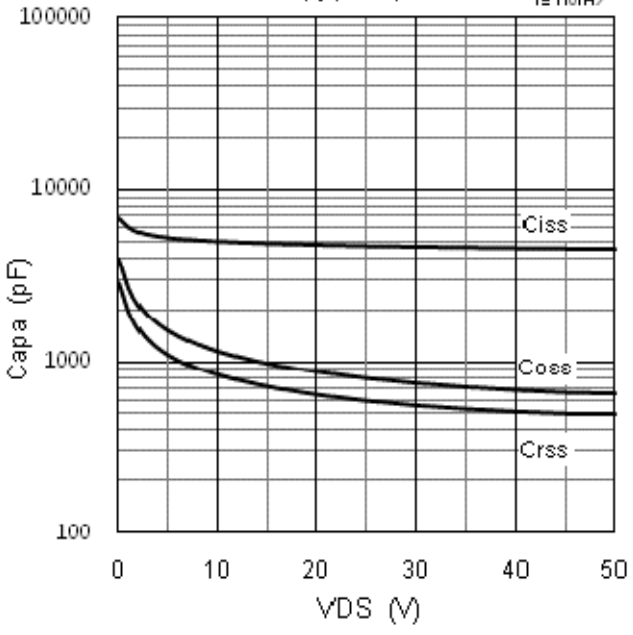
Rc(yfs) - ID characteristics (typical)

VDS=10V

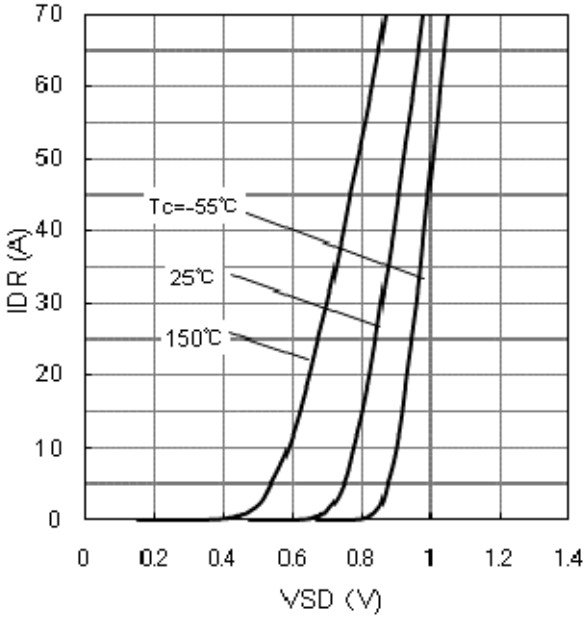


Capacitance VDS characteristics (typical)

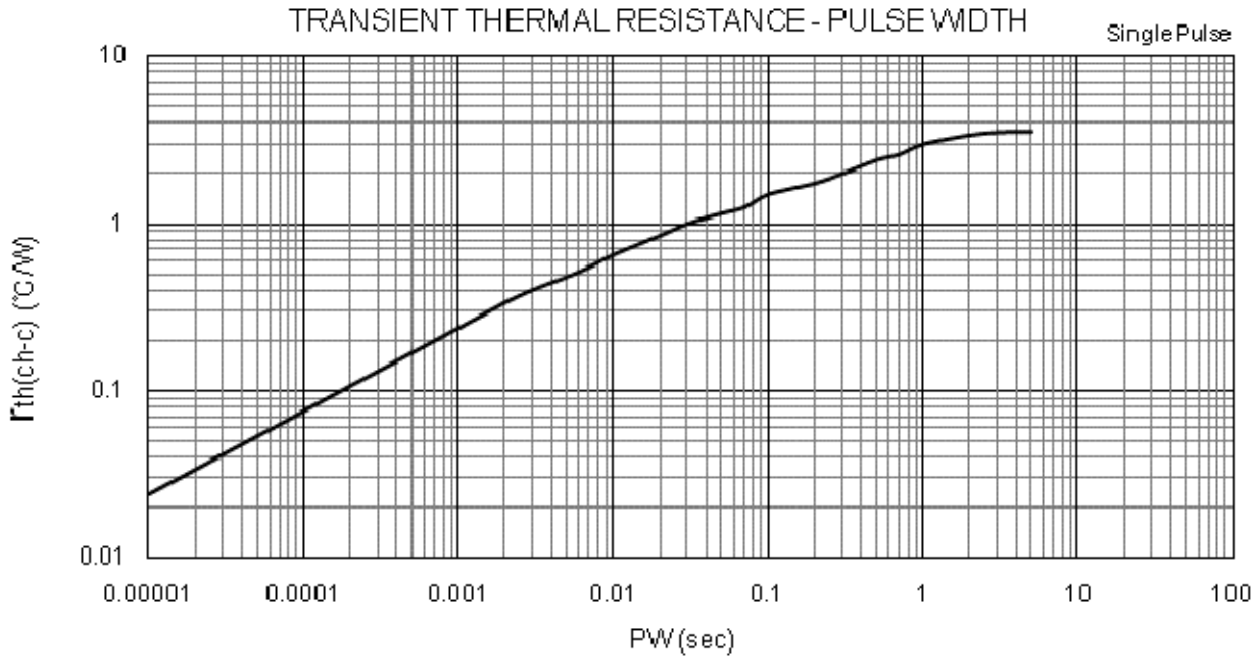
VGS=0V
f=1MHz

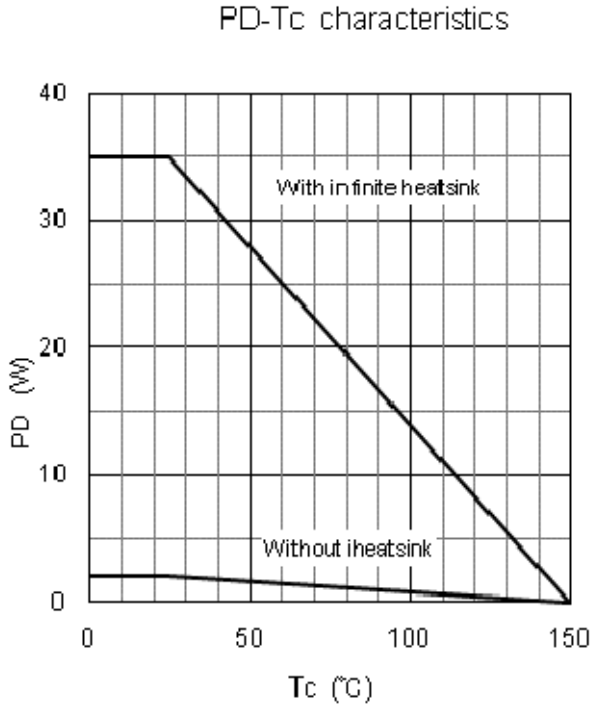


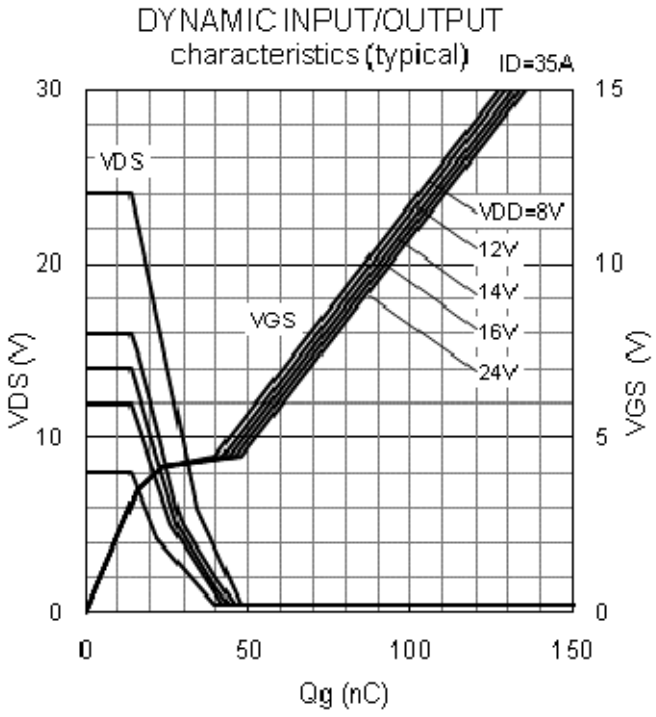
IDR - VSD characteristics (typical)



Characteristic Curves (Tc=25℃)







Characteristic Curves (Tc=25℃)

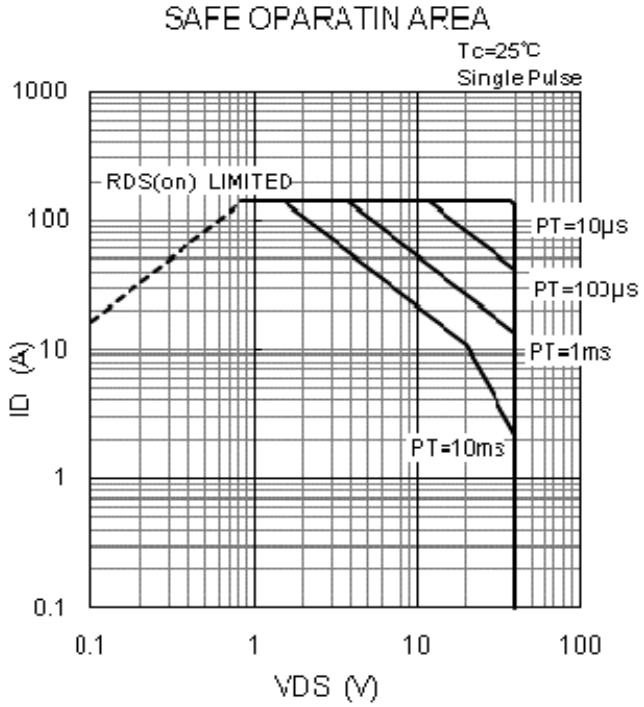
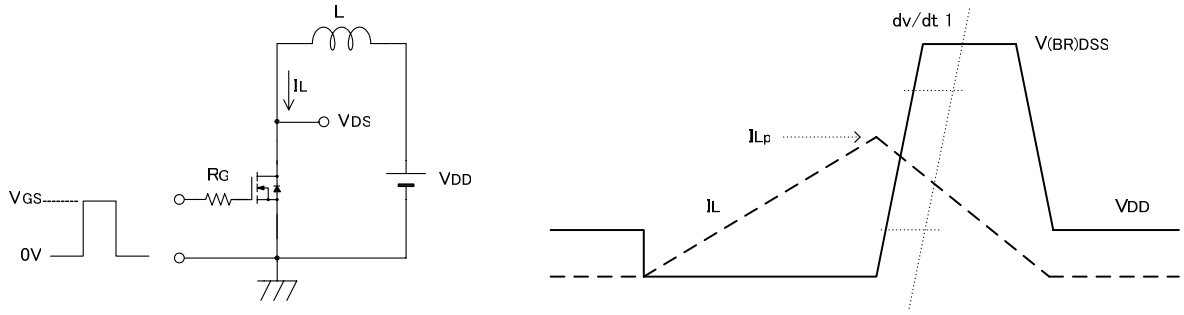


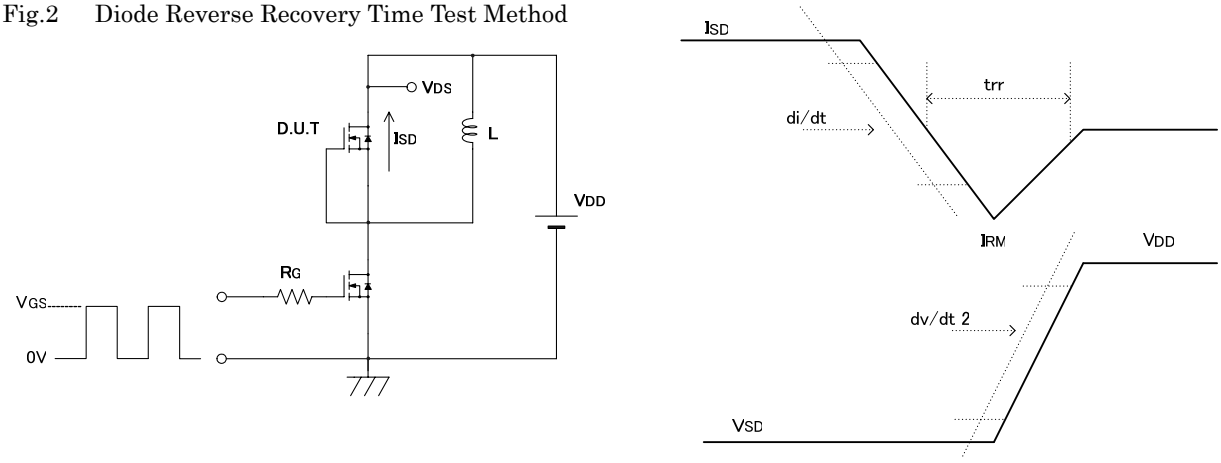
Fig.1 Unclamped Inductive Test Method

$$EAS=\frac{1}{2}\cdot L\cdot ILP^2\cdot\frac{V(BR)DSS}{V(BR)DSS-VDD}$$



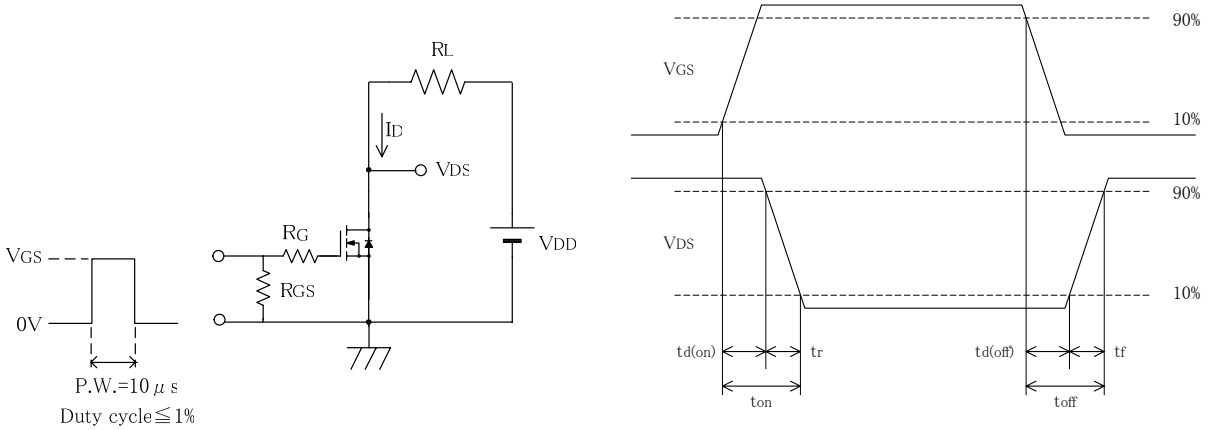
(a) Test Circuit (b) Waveforms

Fig.2 Diode Reverse Recovery Time Test Method



(a) Test Circuit (b) Waveforms

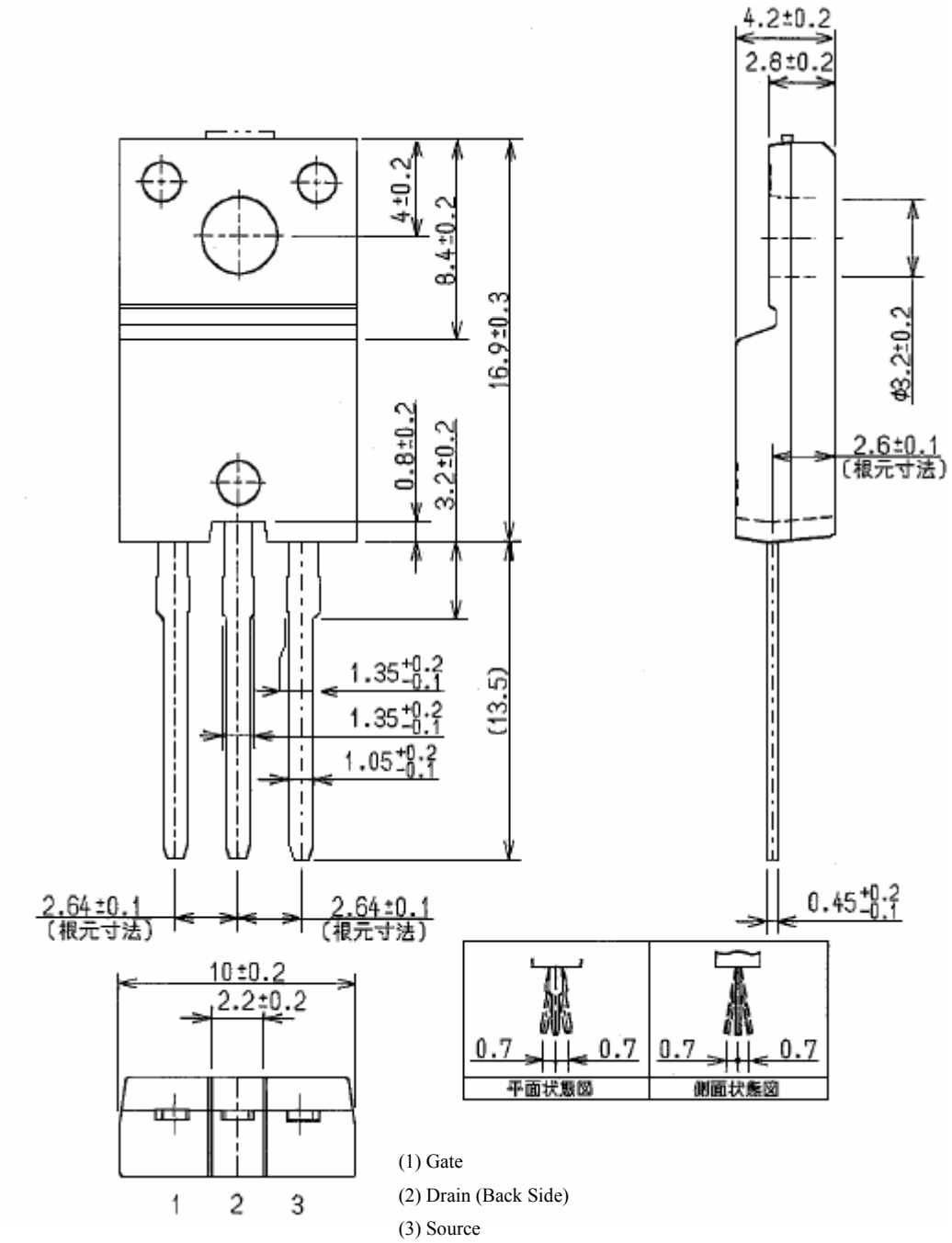
Fig.3 Switching Time Test Method



(a) Test Circuit (b) Waveforms

Outline

FM20 (TO220 Full Mold)



(1) Gate
(2) Drain (Back Side)
(3) Source

Weight Approx. 2g