

# FMV20N60S1

## Super J-MOS series

## N-Channel enhancement mode power MOSFET

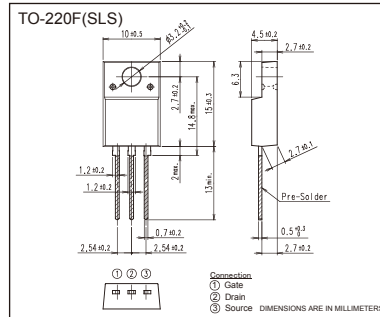
### Features

- Pb-free lead terminal
- RoHS compliant

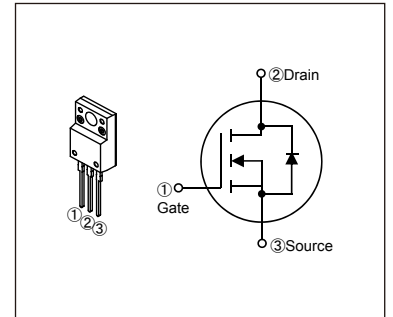
### Applications

- For switching

### Outline Drawings [mm]



### Equivalent circuit schematic



### Maximum Ratings and Characteristics

#### Absolute Maximum Ratings at $T_c=25^\circ\text{C}$ (unless otherwise specified)

Description	Symbol	Characteristics	Unit	Remarks
Drain-Source Voltage	$V_{DS}$	600	V	
	$V_{DSX}$	600	V	$V_{GS}=-30\text{V}$
Continuous Drain Current	$I_D$	$\pm 20$	A	$T_c=25^\circ\text{C}$ Note*1
		$\pm 12.6$	A	$T_c=100^\circ\text{C}$ Note*1
Pulsed Drain Current	$I_{DP}$	$\pm 60$	A	
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V	
Repetitive and Non-Repetitive Maximum Avalanche Current	$I_{AR}$	6.6	A	Note *2
Non-Repetitive Maximum Avalanche Energy	$E_{AS}$	472.2	mJ	Note *3
Maximum Drain-Source dV/dt	$dV_{DS}/dt$	50	kV/ $\mu\text{s}$	$V_{DS}\leq 600\text{V}$
Peak Diode Recovery dV/dt	$dV/dt$	15	kV/ $\mu\text{s}$	Note *4
Peak Diode Recovery -di/dt	$-di/dt$	100	A/ $\mu\text{s}$	Note *5
Maximum Power Dissipation	$P_D$	2.16	W	$T_a=25^\circ\text{C}$
		53		$T_c=25^\circ\text{C}$
Operating and Storage Temperature range	$T_{ch}$	150	$^\circ\text{C}$	
	$T_{stg}$	-55 to +150	$^\circ\text{C}$	
Isolation Voltage	$V_{iso}$	2	kVrms	$t=60\text{sec}, f=60\text{Hz}$

Note \*1 : Limited by maximum channel temperature.

Note \*2 :  $T_{ch}\leq 150^\circ\text{C}$ , See Fig.1 and Fig.2

Note \*3 : Starting  $T_{ch}=25^\circ\text{C}$ ,  $I_{AS}=2\text{A}$ ,  $L=216\text{mH}$ ,  $V_{DD}=60\text{V}$ ,  $R_G=50\Omega$ , See Fig.1 and Fig.2

$E_{AS}$  limited by maximum channel temperature and avalanche current.

Note \*4 :  $I_F\leq -I_D$ ,  $-di/dt=100\text{A}/\mu\text{s}$ ,  $V_{DD}\leq 400\text{V}$ ,  $T_{ch}\leq 150^\circ\text{C}$ .

Note \*5 :  $I_F\leq -I_D$ ,  $dV/dt=15\text{kV}/\mu\text{s}$ ,  $V_{DD}\leq 400\text{V}$ ,  $T_{ch}\leq 150^\circ\text{C}$ .

● Electrical Characteristics at T<sub>c</sub>=25°C (unless otherwise specified)  
Static Ratings

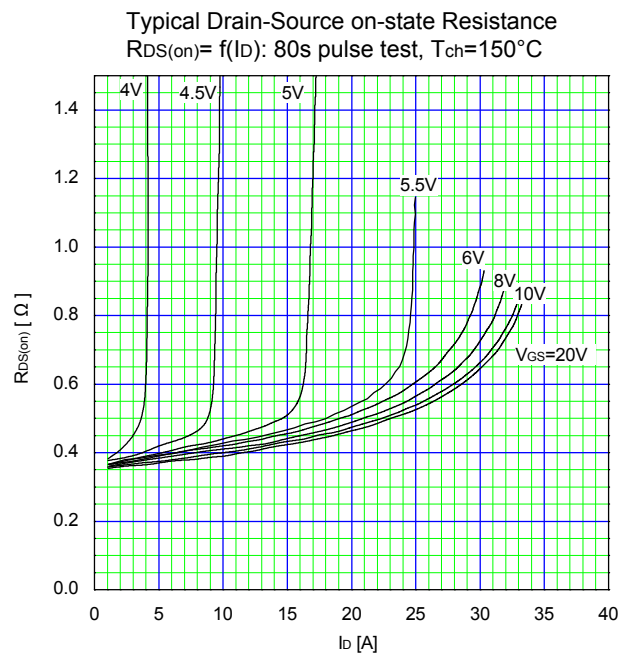
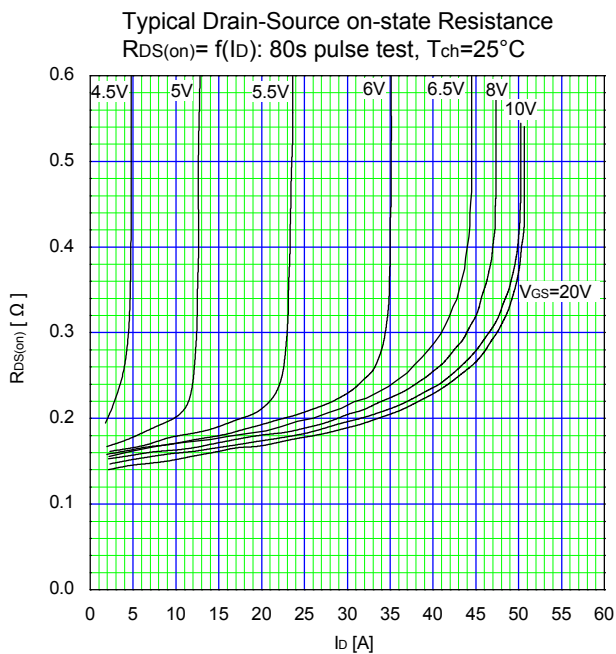
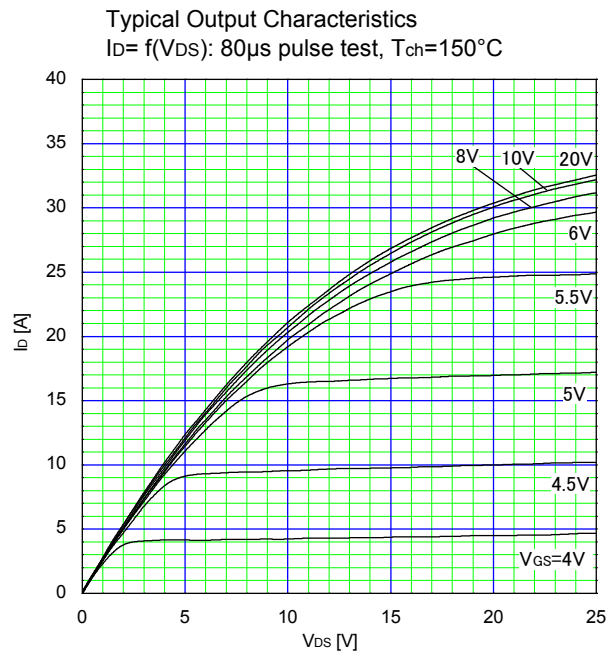
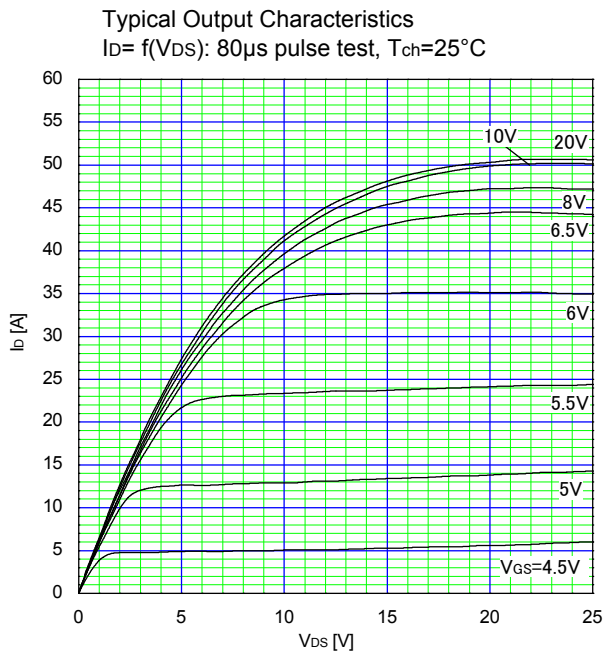
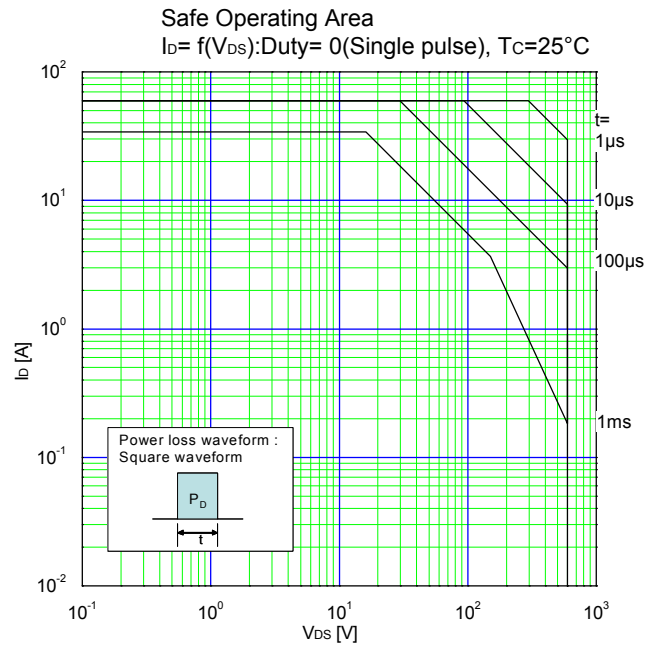
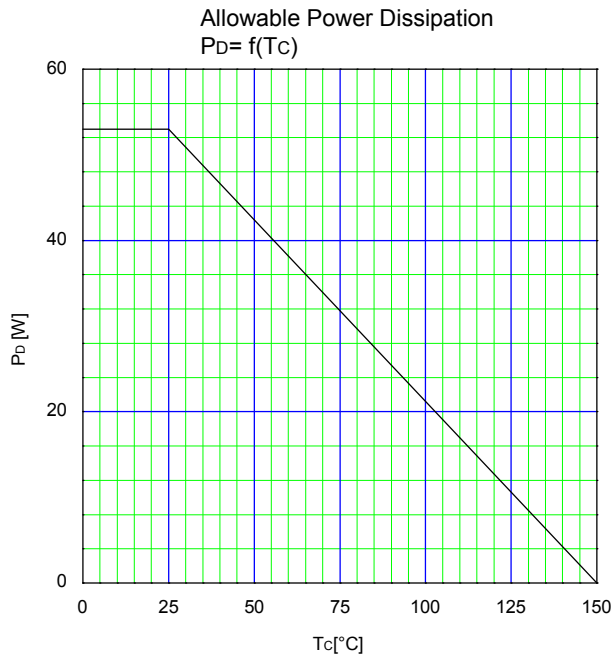
Description	Symbol	Conditions	min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	BV <sub>DSS</sub>	I <sub>D</sub> =250μA V <sub>GS</sub> =0V	600	-	-	V
Gate Threshold Voltage	V <sub>GS(th)</sub>	I <sub>D</sub> =250μA V <sub>DS</sub> =V <sub>GS</sub>	2.5	3	3.5	V
Zero Gate Voltage Drain Current	I <sub>DSS</sub>	V <sub>DS</sub> =600V V <sub>GS</sub> =0V T <sub>ch</sub> =25°C	-	-	25	μA
		V <sub>DS</sub> =480V V <sub>GS</sub> =0V T <sub>ch</sub> =125°C	-	-	250	
Gate-Source Leakage Current	I <sub>GSS</sub>	V <sub>GS</sub> = ± 30V V <sub>DS</sub> =0V	-	10	100	nA
Drain-Source On-State Resistance	R <sub>DS(on)</sub>	I <sub>D</sub> =10A V <sub>GS</sub> =10V	-	0.161	0.19	Ω
Gate resistance	R <sub>G</sub>	f=1MHz, open drain	-	3.7	-	Ω
Forward Transconductance	g <sub>fs</sub>	I <sub>D</sub> =10A V <sub>DS</sub> =25V	8.5	17.5	-	S
Input Capacitance	C <sub>iss</sub>	V <sub>DS</sub> =10V	-	1470	-	pF
Output Capacitance	C <sub>oss</sub>	V <sub>GS</sub> =0V	-	3120	-	
Reverse Transfer Capacitance	C <sub>rss</sub>	f=1MHz	-	280	-	
Effective output capacitance, energy related (Note *6)	C <sub>o(er)</sub>	V <sub>GS</sub> =0V V <sub>DS</sub> =0...480V	-	90	-	
Effective output capacitance, time related (Note *7)	C <sub>o(tr)</sub>	V <sub>GS</sub> =0V V <sub>DS</sub> =0...480V I <sub>D</sub> =constant	-	305	-	
Turn-On Time	t <sub>d(on)</sub>	V <sub>DD</sub> =400V, V <sub>GS</sub> =10V I <sub>D</sub> =10A, R <sub>G</sub> =27Ω See Fig.3 and Fig.4	-	22	-	ns
	t <sub>r</sub>		-	40	-	
Turn-Off Time	t <sub>d(off)</sub>		-	162	-	
	t <sub>f</sub>		-	22	-	
Total Gate Charge	Q <sub>G</sub>	V <sub>DD</sub> =480V, I <sub>D</sub> =20A V <sub>GS</sub> =10V See Fig.5	-	48	-	nC
Gate-Source Charge	Q <sub>GS</sub>		-	12.5	-	
Gate-Drain Charge	Q <sub>GD</sub>		-	15	-	
Drain-Source crossover Charge	Q <sub>SW</sub>		-	8	-	
Avalanche Capability	I <sub>AV</sub>	L=6.02mH, T <sub>ch</sub> =25°C See Fig.1 and Fig.2	6.6	-	-	A
Diode Forward On-Voltage	V <sub>SD</sub>	I <sub>F</sub> =20A, V <sub>GS</sub> =0V T <sub>ch</sub> =25°C	-	0.9	1.35	V
Reverse Recovery Time	t <sub>rr</sub>	I <sub>F</sub> =20A, V <sub>GS</sub> =0V	-	370	-	ns
Reverse Recovery Charge	Q <sub>rr</sub>	V <sub>DD</sub> =400V -di/dt=100A/μs T <sub>ch</sub> =25°C	-	6.2	-	μC
Peak Reverse Recovery Current	I <sub>rp</sub>	See Fig.6	-	32	-	A

Note \*6 : C<sub>o(er)</sub> is a fixed capacitance that gives the same stored energy as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% BV<sub>DSS</sub>.

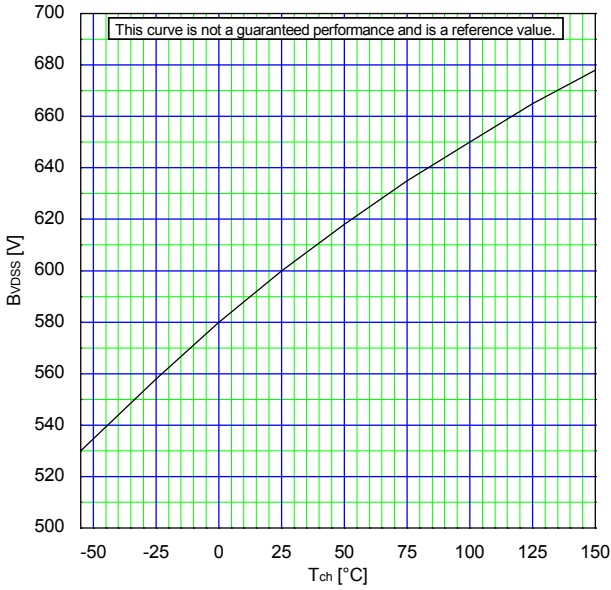
Note \*7 : C<sub>o(tr)</sub> is a fixed capacitance that gives the same charging times as C<sub>oss</sub> while V<sub>DS</sub> is rising from 0 to 80% BV<sub>DSS</sub>.

● Thermal Characteristics

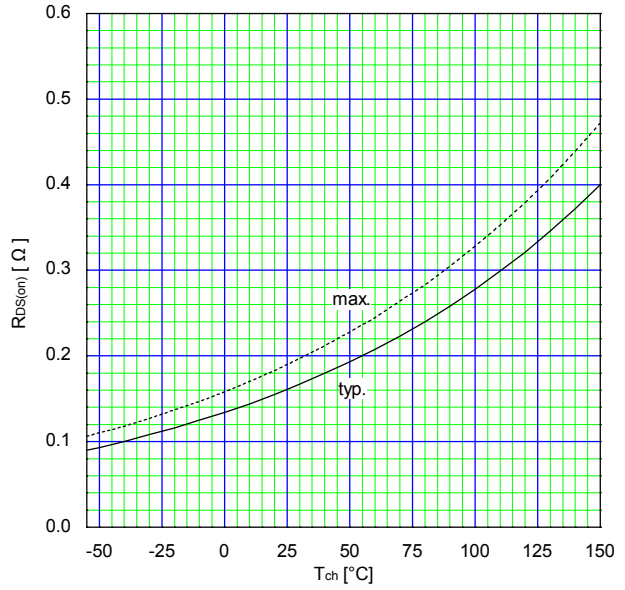
Description	Symbol	min.	typ.	max.	Unit
Channel to Case	R <sub>th(ch-c)</sub>			2.36	°C/W
Channel to Ambient	R <sub>th(ch-a)</sub>			58	°C/W



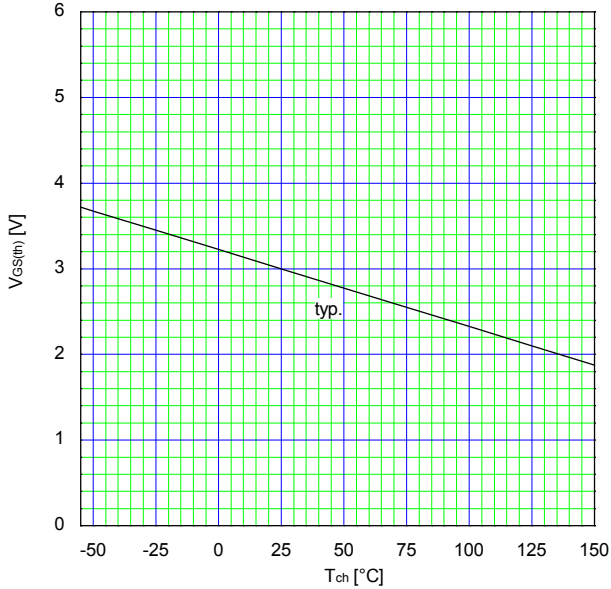
Drain-Source Breakdown Voltage  
 $B_{VDS} = f(T_{ch})$ :  $I_D = 10mA$ ,  $V_{GS} = 0V$



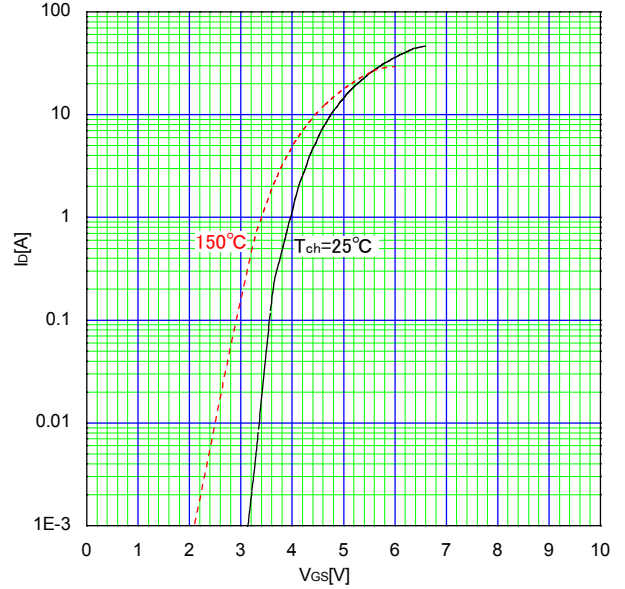
Drain-Source On-state Resistance  
 $R_{DS(on)} = f(T_{ch})$ :  $I_D = 10A$ ,  $V_{GS} = 10V$



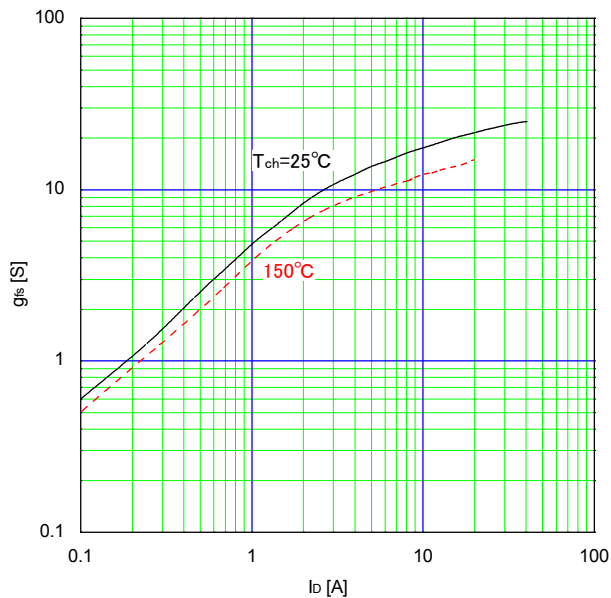
Gate Threshold Voltage vs.  $T_{ch}$   
 $V_{GS(th)} = f(T_{ch})$ :  $V_{DS} = V_{GS}$ ,  $I_D = 250\mu A$



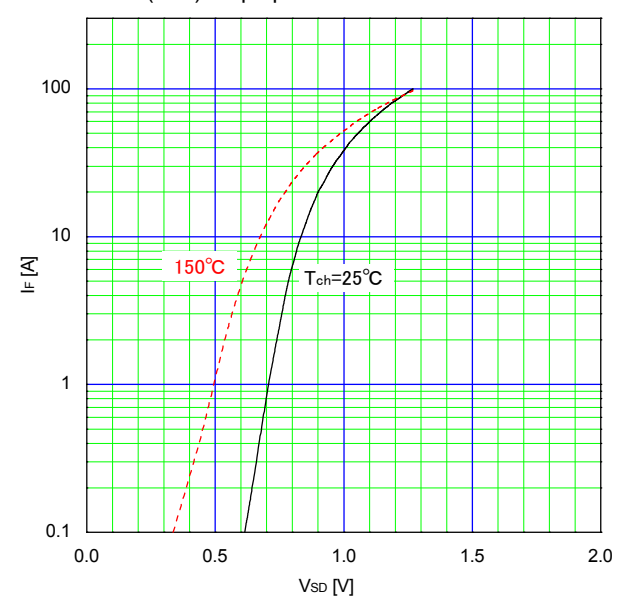
Typical Transfer Characteristic  
 $I_D = f(V_{GS})$ : 80μs pulse test,  $V_{DS} = 25V$

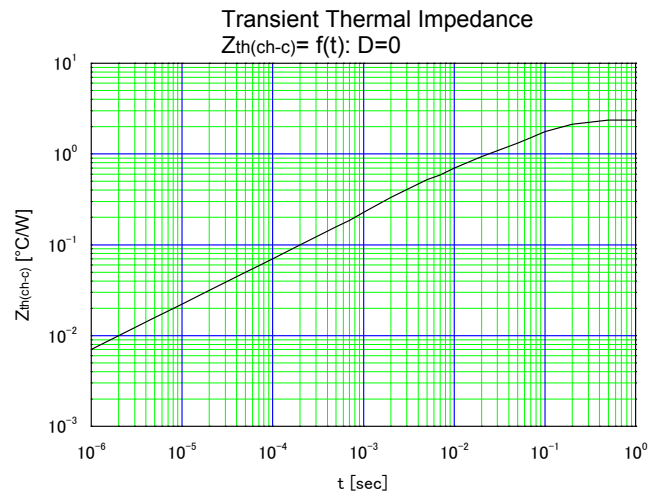
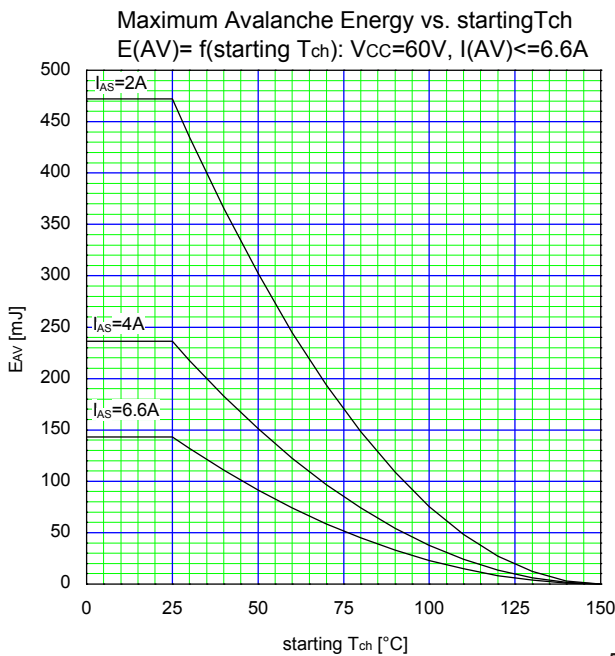
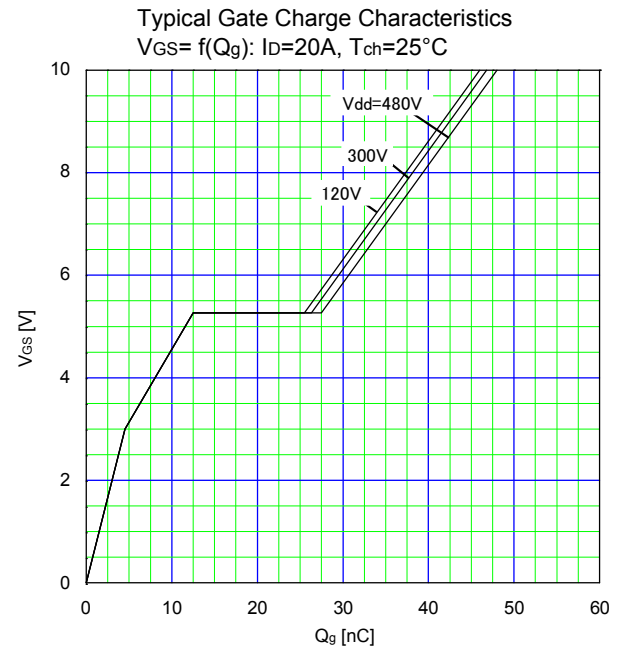
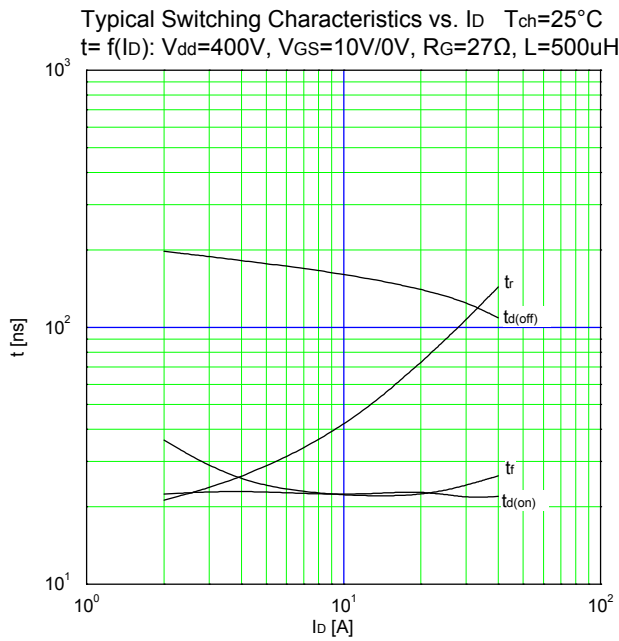
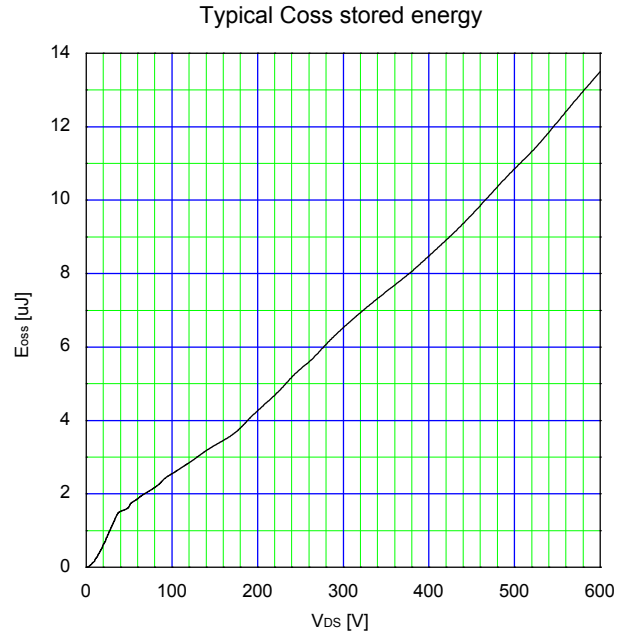
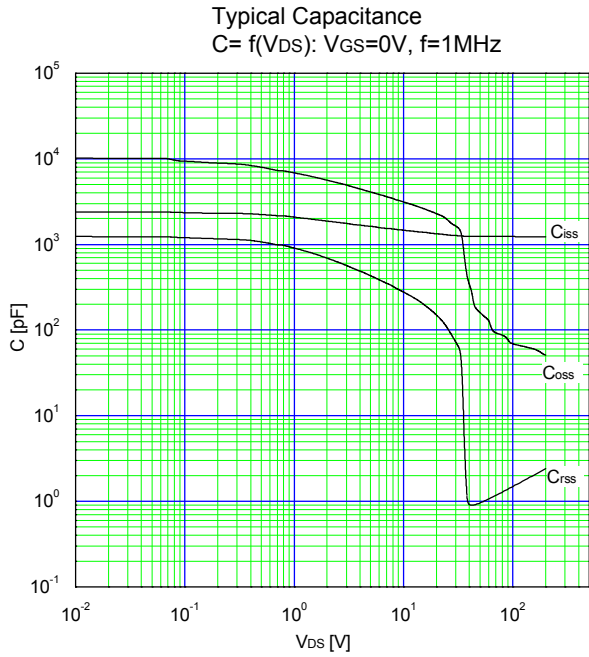


Typical Transconductance  
 $g_{fs} = f(I_D)$ : 80μs pulse test,  $V_{DS} = 25V$



Typical Forward Characteristics of Reverse Diode  
 $I_F = f(V_{SD})$ : 80μs pulse test





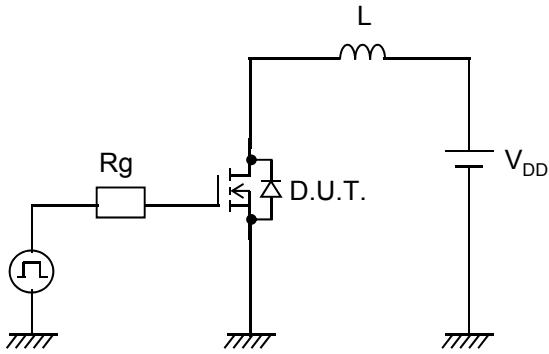


Fig.1 Avalanche Test circuit

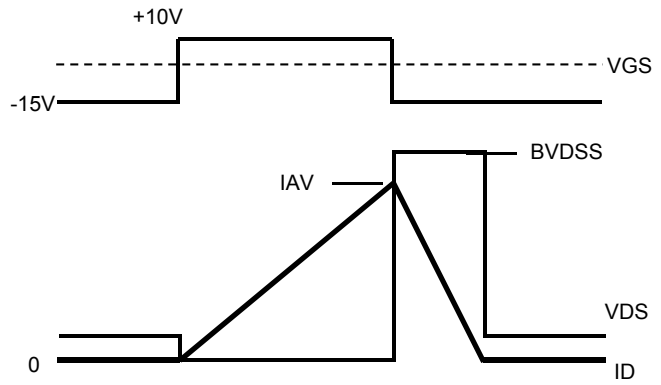


Fig.2 Operating waveforms of Avalanche Test

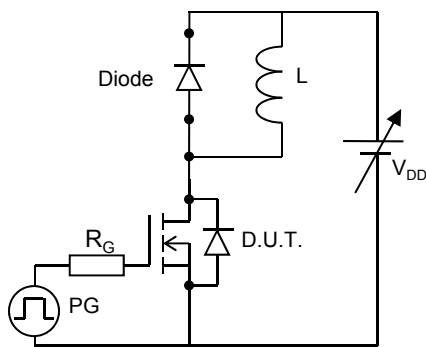


Fig.3 Switching Test circuit

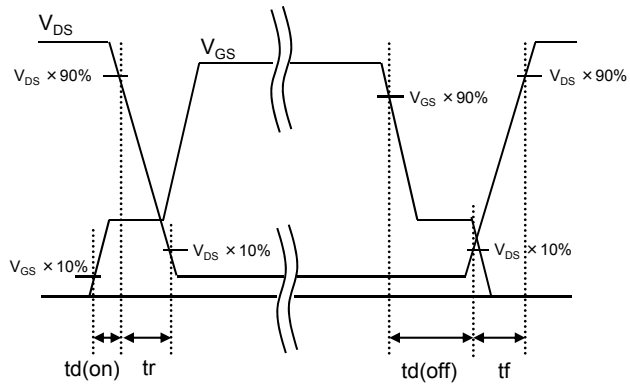


Fig.4 Operating waveform of Switching Test

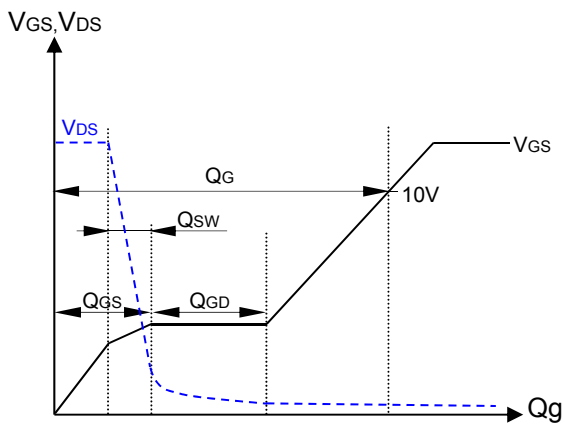


Fig.5 Operating waveform of Gate charge Test

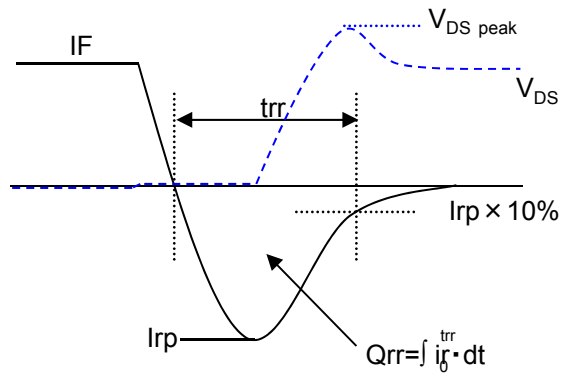
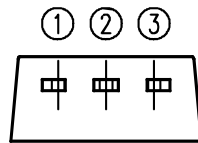
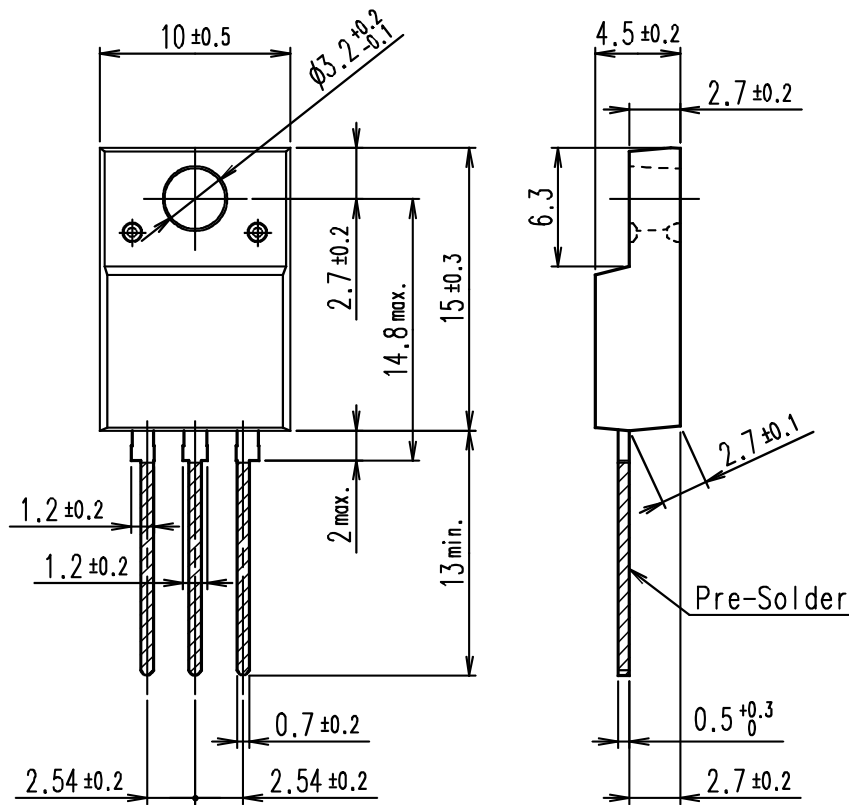


Fig.6 Operating waveform of Reverse recovery Test

■ Outview: TO-220F(SLS) Package

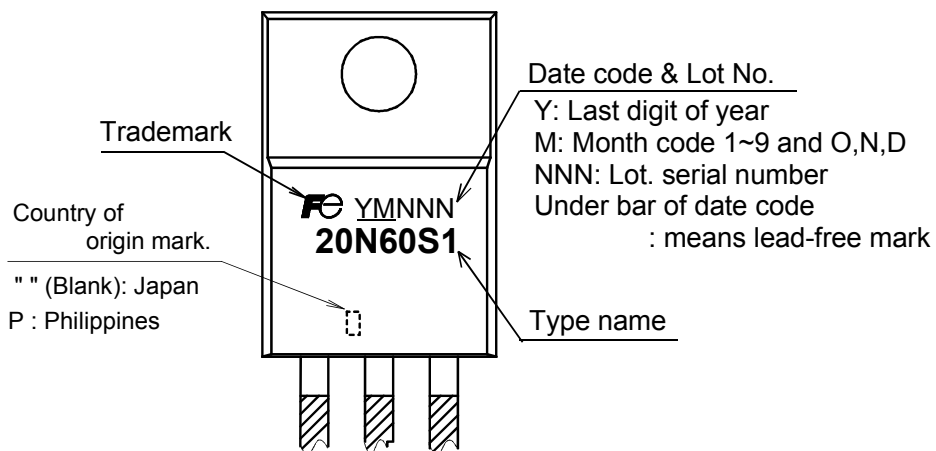


Connection

- ① Gate
- ② Drain
- ③ Source

DIMENSIONS ARE IN MILLIMETERS.

■ Marking



\* The font (font type,size) and the trademark-size might be actually different.

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