

# FMW60N040S2HF <http://www.fujielectric.com/products/semiconductor/>

FUJI POWER MOSFET

## Super J MOS<sup>®</sup> S2 series

N-Channel enhancement mode power MOSFET

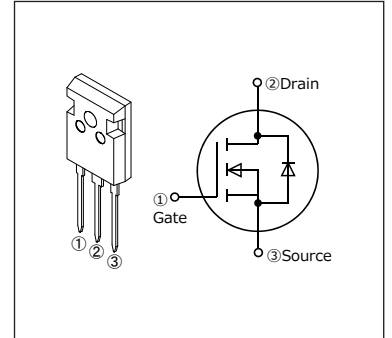
### ■ Features

- Pb-free lead terminal
- RoHS compliant
- uses Halogen-free molding compound

### ■ Applications

- For switching

### ■ Equivalent circuit schematic



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

Parameter	Symbol	Characteristics	Unit	Remarks
Drain-Source Voltage	$V_{DS}$	600	V	
	$V_{DSX}$	600	V	$V_{GS}=-30\text{V}$
Continuous Drain Current	$I_D$	77.5	A	$T_c=25^\circ\text{C}$ Note*1,2
		49	A	$T_c=100^\circ\text{C}$ Note*1,2
Pulsed Drain Current	$I_{DP}$	265	A	Note *2
Gate-Source Voltage	$V_{GS}$	$\pm 30$	V	
Non-Repetitive Maximum Avalanche Current	$I_{AS}$	7.5	A	Note *3
Non-Repetitive Maximum Avalanche Energy	$E_{AS}$	2947	mJ	Note *4
Maximum Drain-Source $dV/dt$	$dV_{DS}/dt$	50	V/ns	$V_{DS} \leq 600\text{V}$
Continuous Diode Forward Current	$I_{SD}$	77.5	A	$T_c=25^\circ\text{C}$ Note*1,2
		49	A	$T_c=100^\circ\text{C}$ Note*1,2
Pulsed Diode Forward Current	$I_{SDP}$	265	A	Note *2
Peak Diode Recovery $dV/dt$	$dV/dt$	15	V/ns	Note *5
Peak Diode Recovery $-di/dt$	$-di/dt$	100	A/ $\mu\text{s}$	Note *6
Maximum Power Dissipation	$P_D$	2.5	W	$T_a=25^\circ\text{C}$
		435		$T_c=25^\circ\text{C}$
Operating and Storage Temperature range	$T_{ch}$	150	$^\circ\text{C}$	
	$T_{stg}$	-55 to +150	$^\circ\text{C}$	

Note \*1 : Maximum duty cycle  $D=0.73$

Note \*2 : Limited by maximum channel temperature.

Note \*3 :  $T_{ch} \leq 150^\circ\text{C}$ , See Fig.1 and Fig.2

Note \*4 : Starting  $T_{ch}=25^\circ\text{C}$ ,  $I_{AS}=4.5\text{A}$ ,  $L=267\text{mH}$ ,  $V_{DD}=60\text{V}$ ,  $R_G=50\Omega$ , See Fig.1 and Fig.2

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

Note \*5 :  $I_{SD} \leq 66.2\text{A}$ ,  $-di/dt \leq 100\text{A}/\mu\text{s}$ ,  $V_{DS \text{ peak}} \leq 600\text{V}$ ,  $T_{ch} \leq 150^\circ\text{C}$ .

Note \*6 :  $I_{SD} \leq 66.2\text{A}$ ,  $dV/dt \leq 15\text{V}/\text{ns}$ ,  $V_{DS \text{ peak}} \leq 600\text{V}$ ,  $T_{ch} \leq 150^\circ\text{C}$ .

**Electrical Characteristics at  $T_c=25^\circ\text{C}$  (unless otherwise specified)**

**• Static Ratings**

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	$BV_{DSS}$	$V_{GS}=0V$ $I_D=250\mu A$	600	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS}=V_{GS}$ $I_D=3.85mA$	3.5	4.0	4.5	V
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS}=600V$ $V_{GS}=0V$ $T_{ch}=25^\circ\text{C}$	-	-	25	$\mu A$
		$V_{DS}=480V$ $V_{GS}=0V$ $T_{ch}=125^\circ\text{C}$	-	-	250	
Gate-Source Leakage Current	$I_{GSS}$	$V_{DS}=0V$ $V_{GS}=\pm 30V$	-	10	100	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS}=10V$ $I_D=33.1A$	-	0.037	0.040	$\Omega$
Gate resistance	$R_G$	f=1MHz, open drain	-	4.6	-	$\Omega$

**• Dynamic Ratings**

Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Forward Transconductance	$g_{fs}$	$V_{DS}=25V$ $I_D=33.1A$	24	48	-	S
Input Capacitance	$C_{iss}$	$V_{DS}=400V$ $V_{GS}=0V$ f=250kHz	-	3830	-	$\mu F$
Output Capacitance	$C_{oss}$		-	126	-	
Reverse Transfer Capacitance	$C_{rss}$		-	14.2	-	
Effective output capacitance, energy related (Note *7)	$C_{o(er)}$	$V_{DS}=0\dots 400V$ $V_{GS}=0V$	-	286	-	$\mu F$
Effective output capacitance, time related (Note *8)	$C_{o(tr)}$	$V_{DS}=0\dots 400V$ $V_{GS}=0V$ $I_D=\text{constant}$	-	1178	-	$\mu F$
Turn-On Time	$t_{d(on)}$	$V_{DD}=400V, V_{GS}=10V$ $I_D=33.1A,$ $R_G=9.1\Omega$ See Fig.3 and Fig.4	-	42	-	ns
	$t_t$		-	167	-	
Turn-Off Time	$t_{d(off)}$		-	178	-	
	$t_t$		-	27	-	
Total Gate Charge	$Q_G$	$V_{DD}=400V, V_{GS}=10V$ $I_D=66.2A$ See Fig.5	-	147	-	nC
Gate-Source Charge	$Q_{GS}$		-	60	-	
Gate-Drain Charge	$Q_{GD}$		-	64	-	
Drain-Source crossover Charge	$Q_{SW}$		-	41	-	

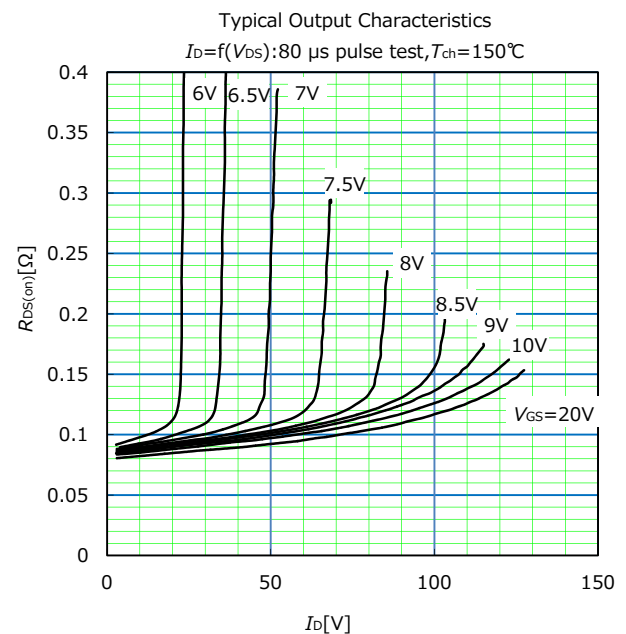
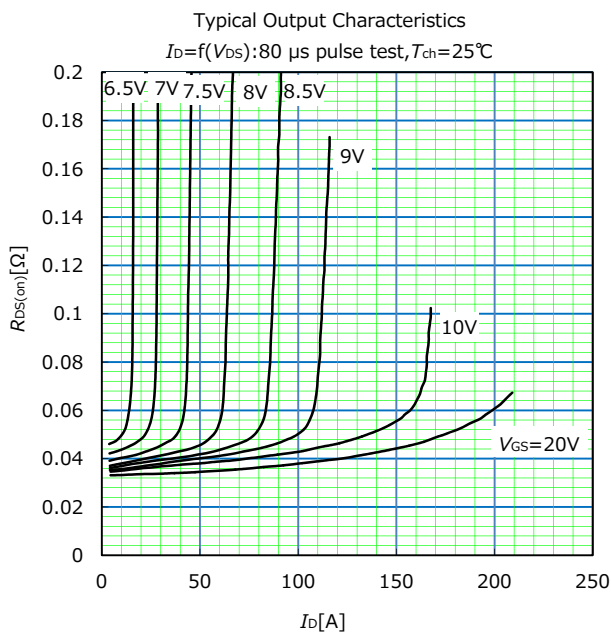
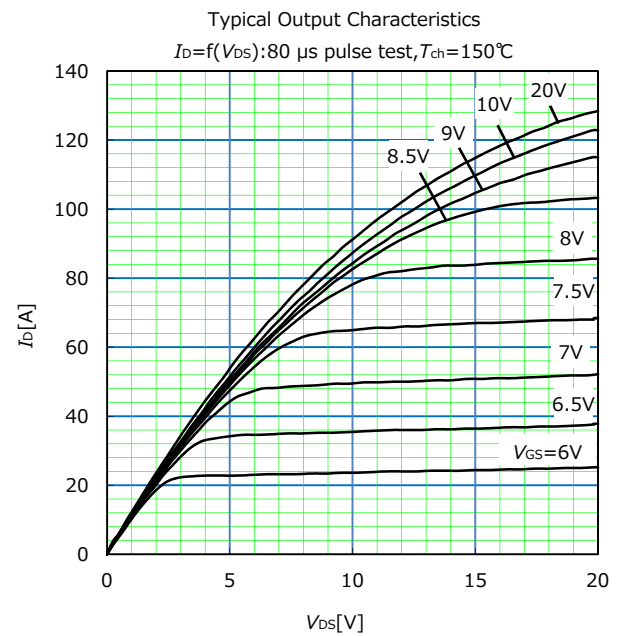
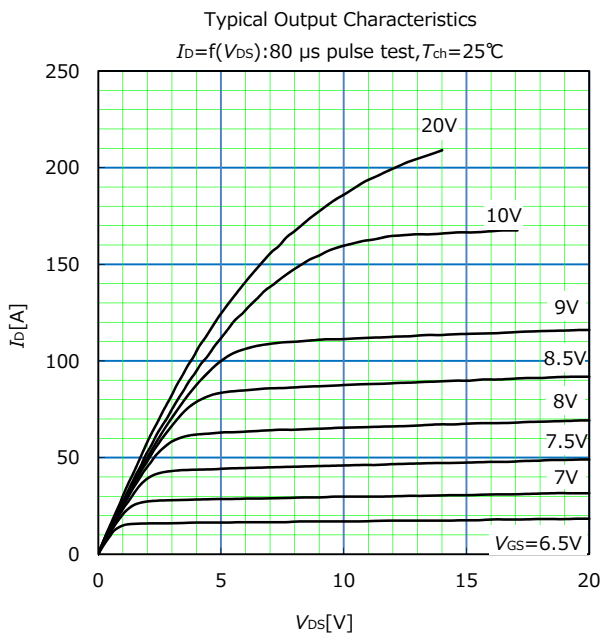
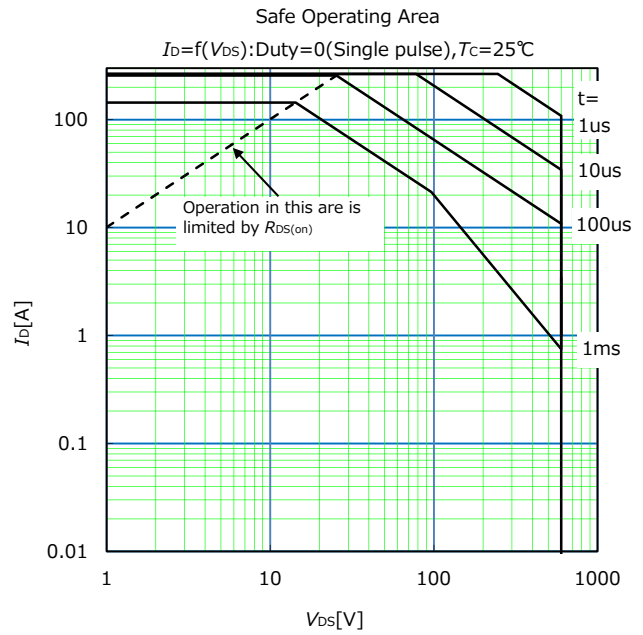
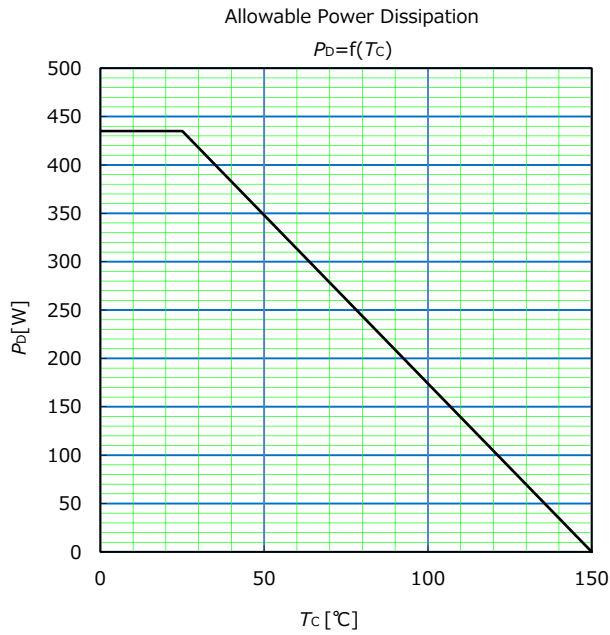
Note \*7 :  $C_{o(er)}$  is a fixed capacitance that gives the same stored energy as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 400V.  
Note \*8 :  $C_{o(tr)}$  is a fixed capacitance that gives the same charging times as  $C_{oss}$  while  $V_{DS}$  is rising from 0 to 400V.

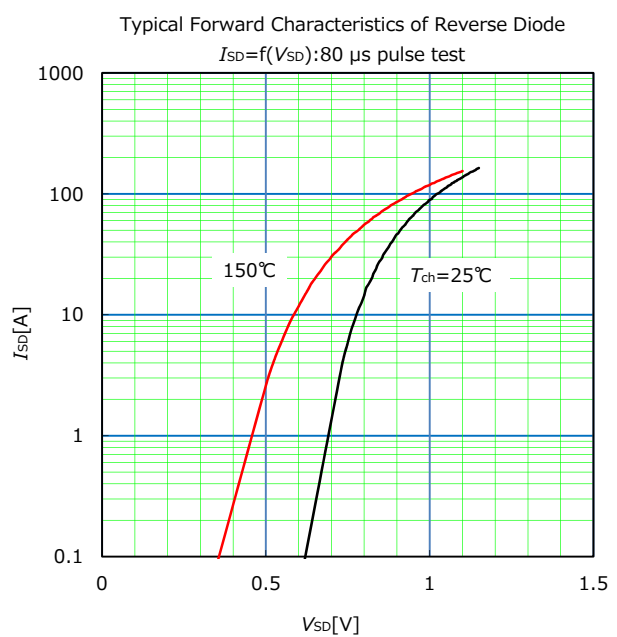
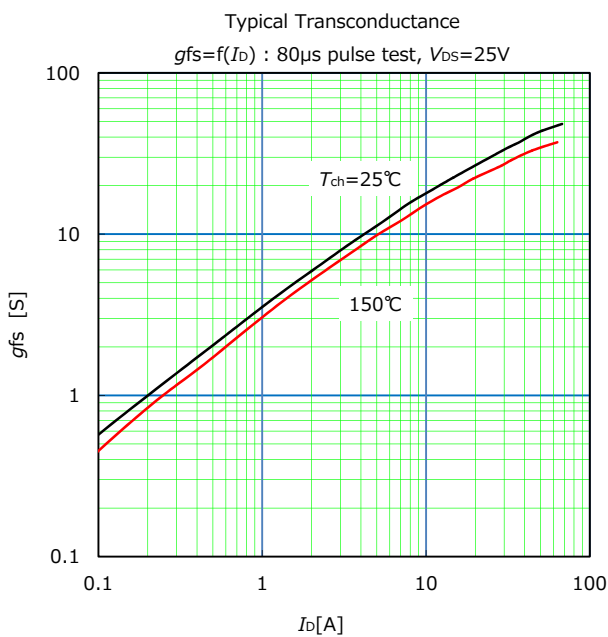
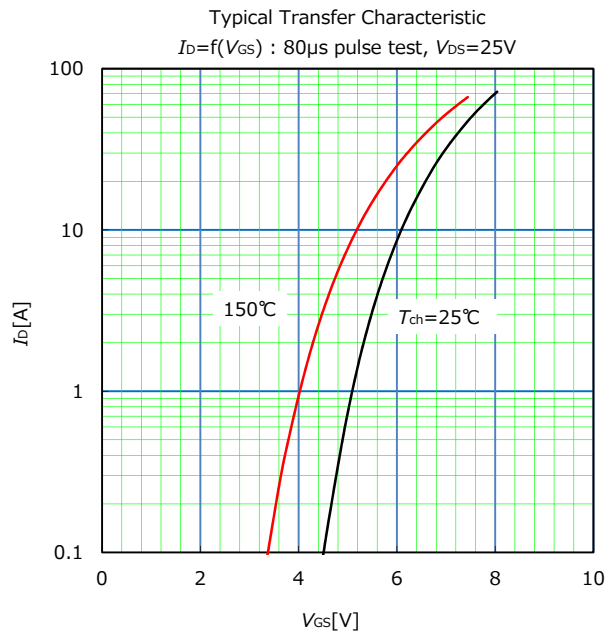
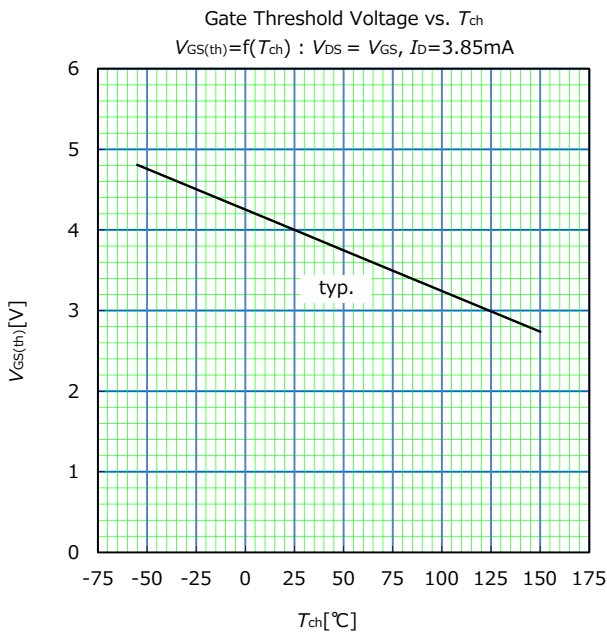
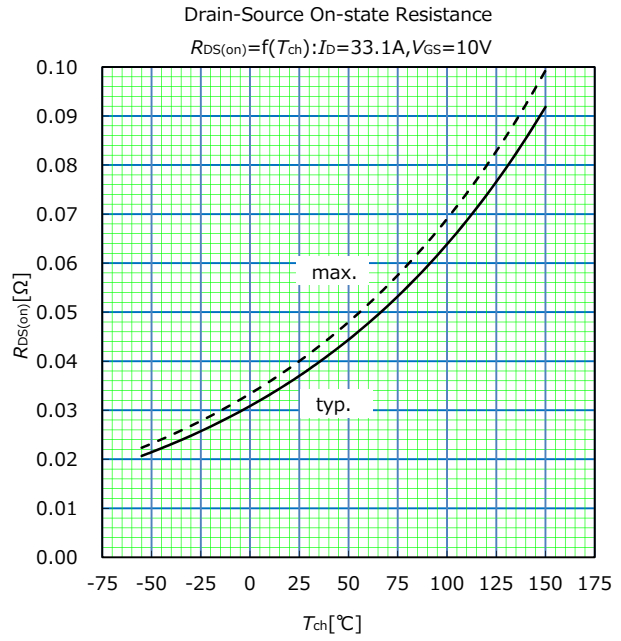
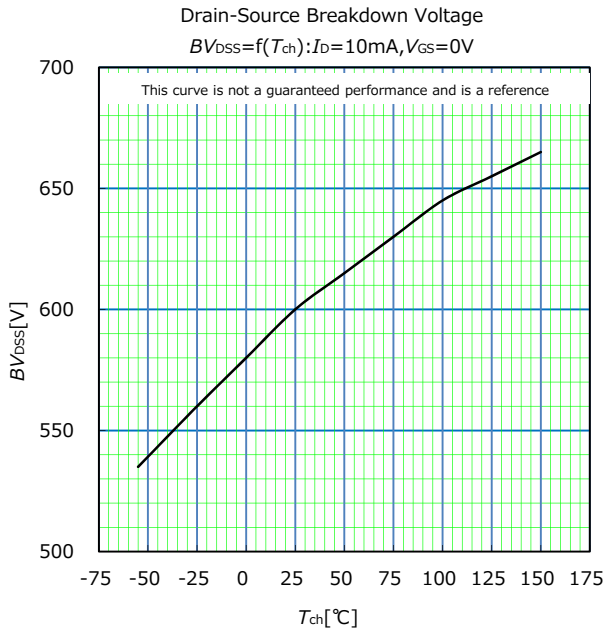
**• Reverse Diode**

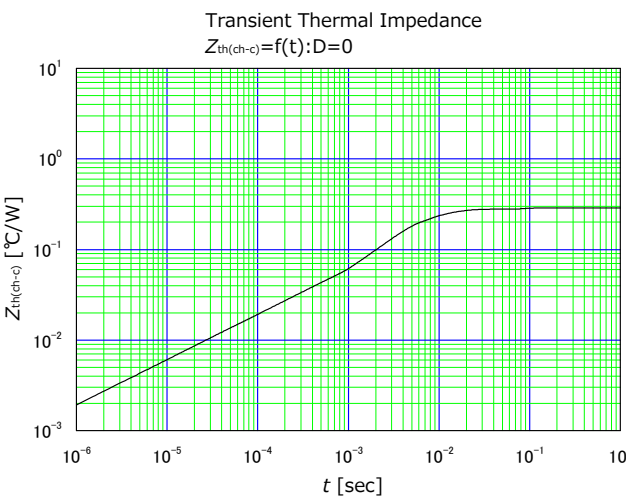
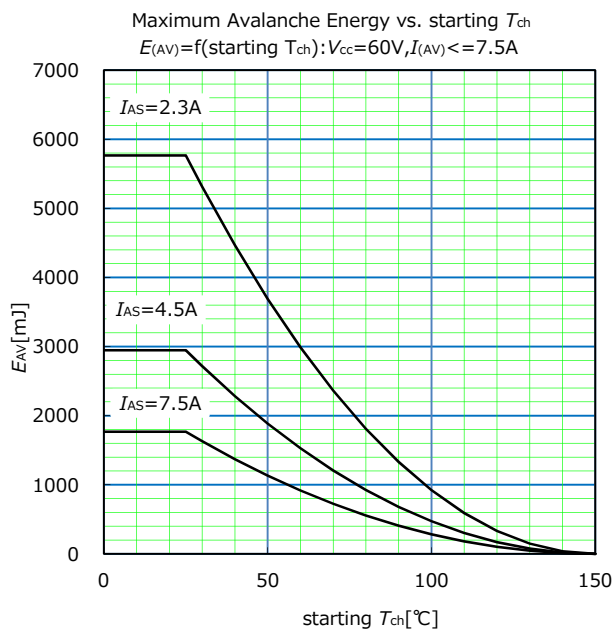
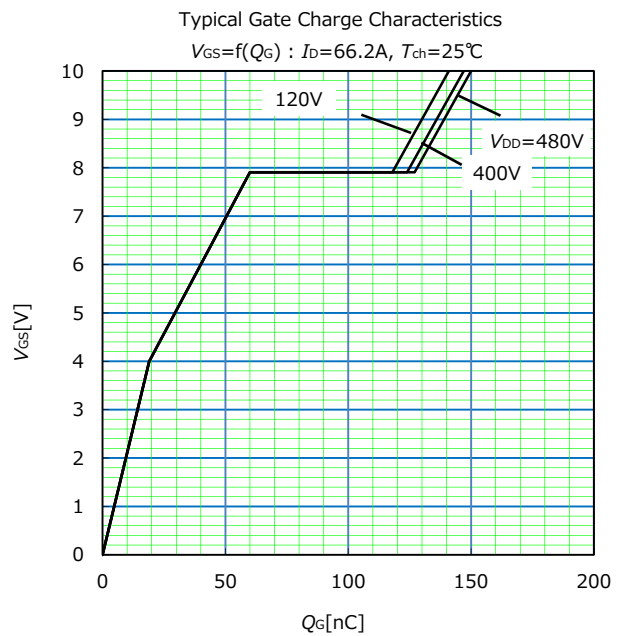
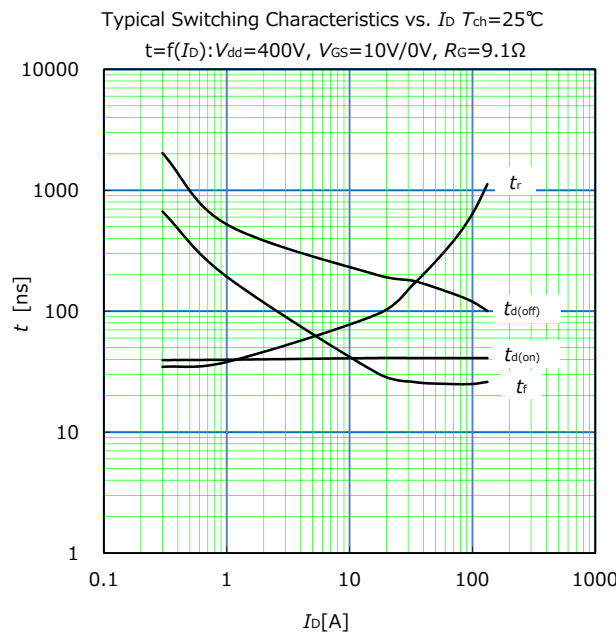
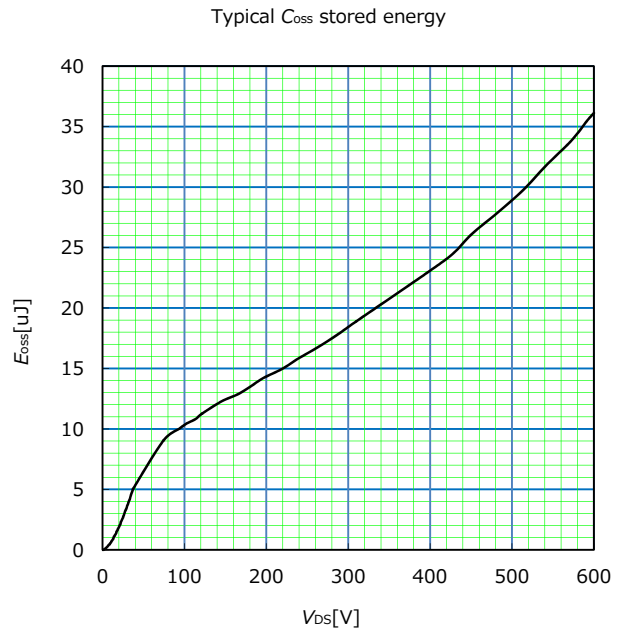
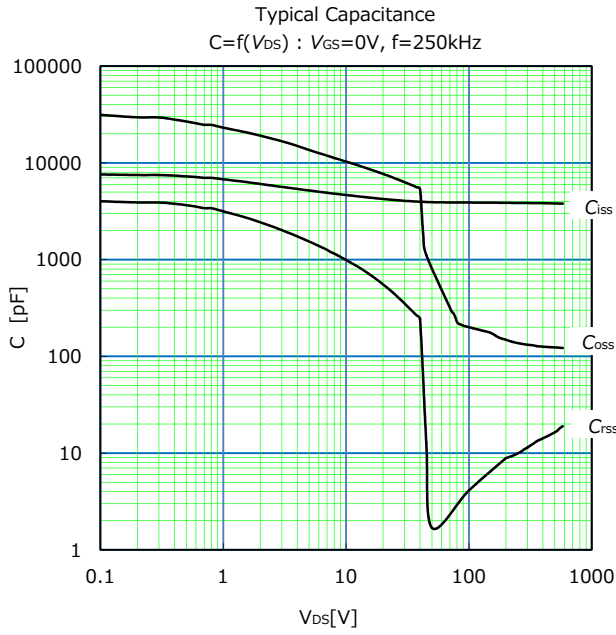
Parameter	Symbol	Conditions	min.	typ.	max.	Unit
Diode Forward On-Voltage	$V_{SD}$	$I_{SD}=66.2A, V_{GS}=0V$ $T_{ch}=25^\circ\text{C}$	-	0.95	1.35	V
Reverse Recovery Time	$t_{rr}$	$V_{DD}=400V, I_{SD}=66.2A$ -di/dt=100A/ $\mu s$ $T_{ch}=25^\circ\text{C}$ See Fig.6 and Fig.7	-	465	-	ns
Reverse Recovery Charge	$Q_{rr}$		-	10	-	$\mu C$
Peak Reverse Recovery Current	$I_{rp}$		-	41.5	-	A

**Thermal Resistance**

Parameter	Symbol	min.	typ.	max.	Unit
Channel to Case	$R_{th(ch-c)}$	-	-	0.29	$^\circ\text{C}/\text{W}$
Channel to Ambient	$R_{th(ch-a)}$	-	-	50	$^\circ\text{C}/\text{W}$







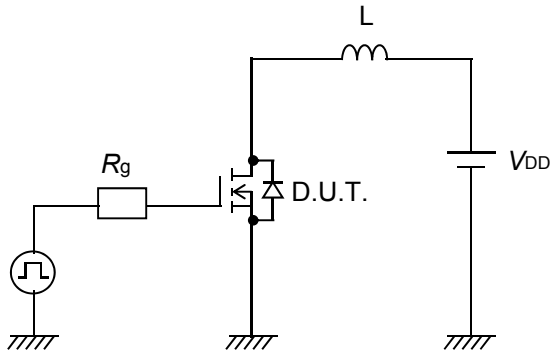


Fig.1 Avalanche Test circuit

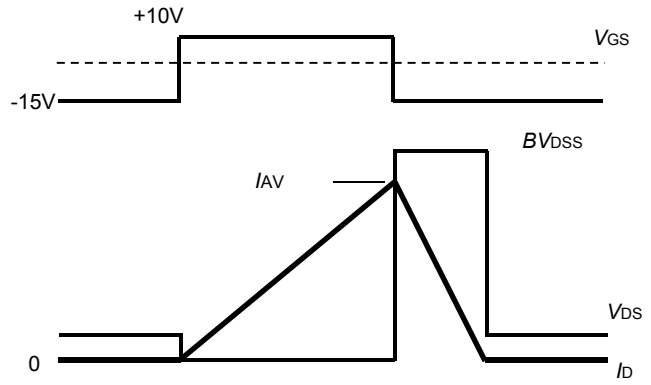


Fig.2 Operating waveforms of Avalanche Test

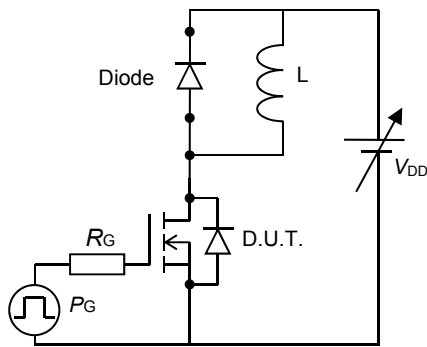


Fig.3 Switching Test circuit

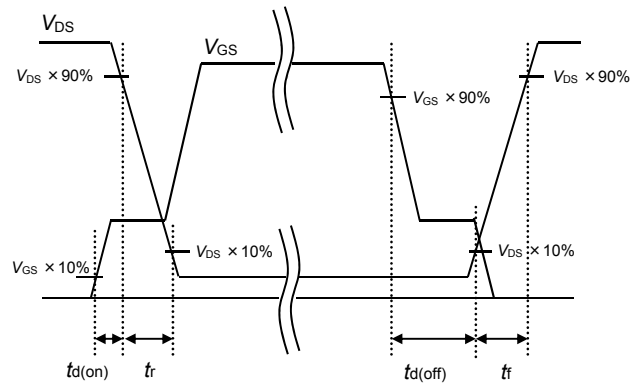


Fig.4 Operating waveform of Switching Test

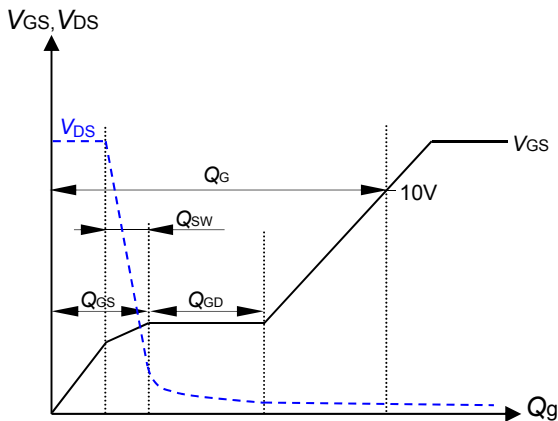


Fig.5 Operating waveform of Gate charge Test

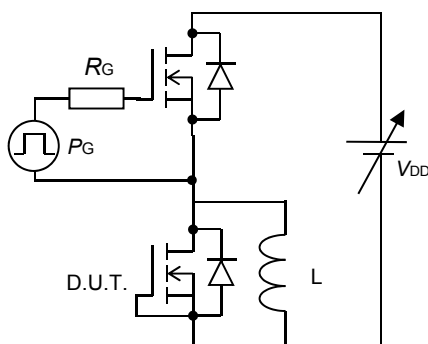


Fig.6 Reverse recovery Test circuit

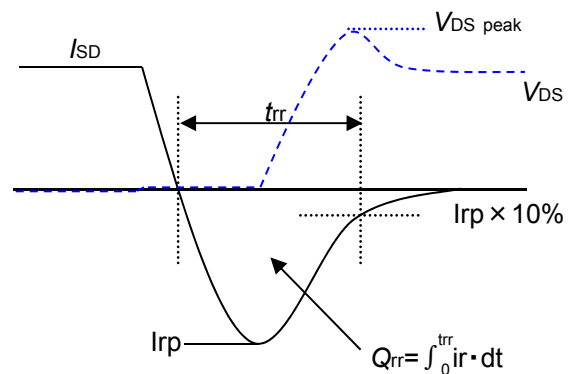
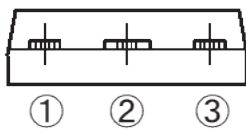
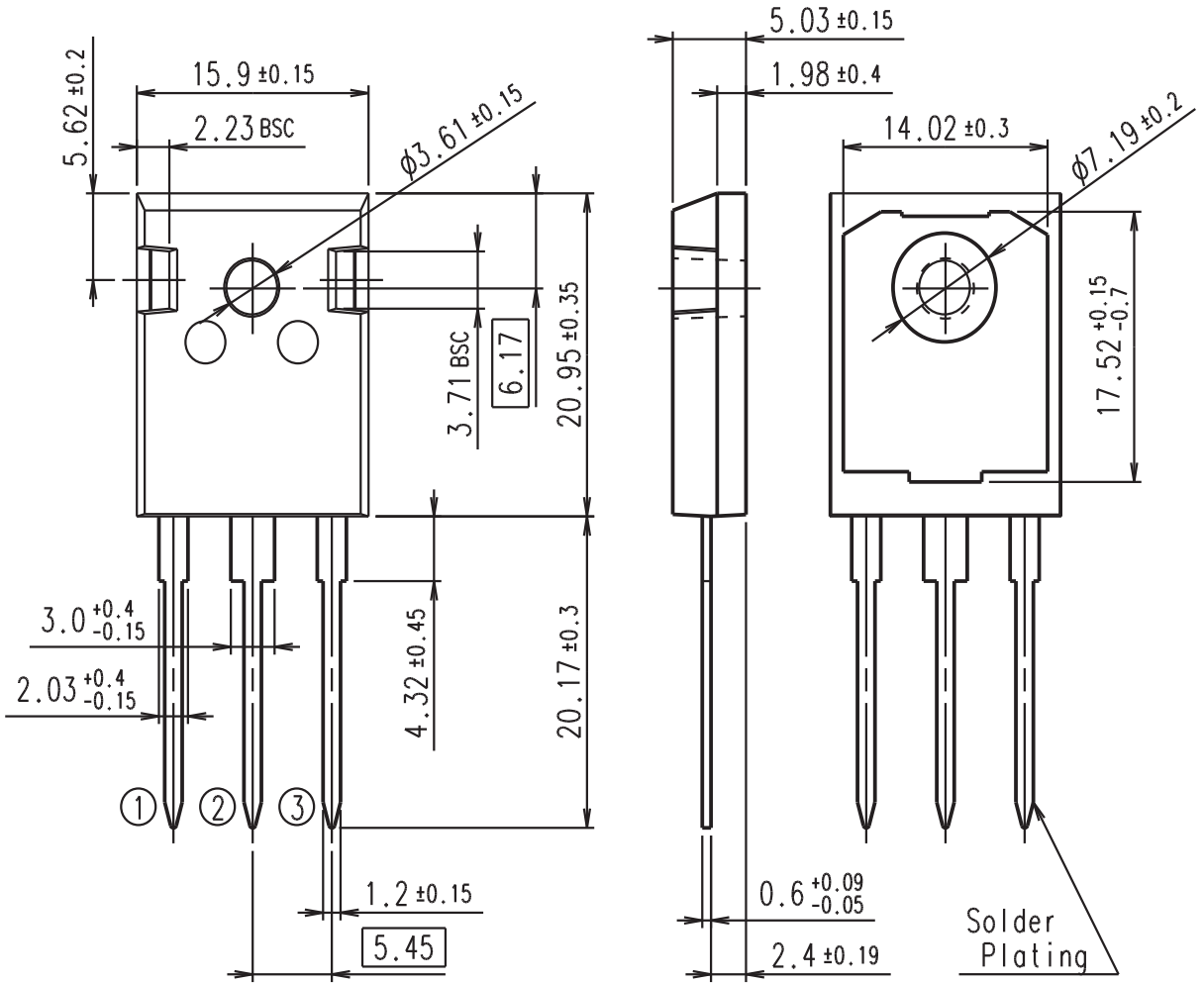


Fig.7 Operating waveform of Reverse recovery Test

■ Outview: TO-247-P/TO-247-P2 Package

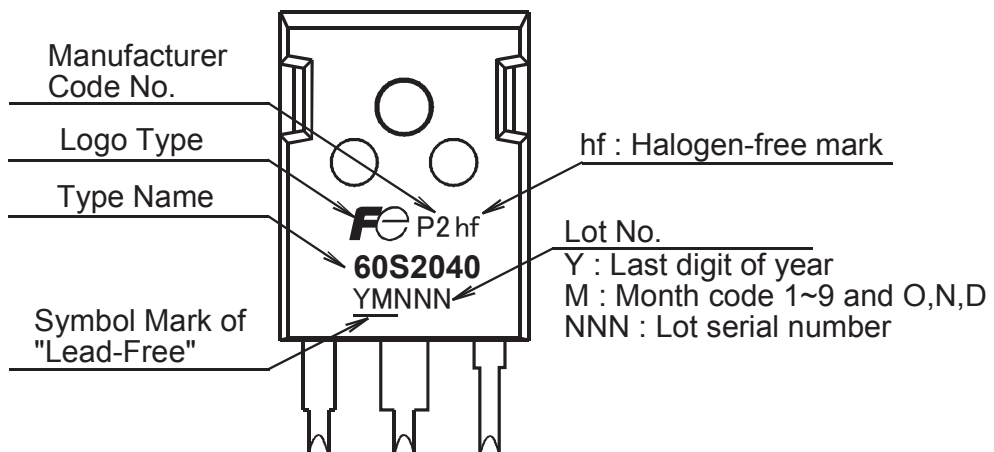


CONNECTION

- ① GATE
- ② COLLECTOR
- ③ EMITTER

DIMENSIONS ARE IN MILLIMETERS.

■ Marking



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

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  - Gas leakage detectors with an auto-shut-off feature
  - Emergency equipment for responding to disasters and anti-burglary devices
  - Safety devices
  - Medical equipment
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