

FMH23N50E

FUJI POWER MOSFET

Super FAP-E³ series

N-CHANNEL SILICON POWER MOSFET

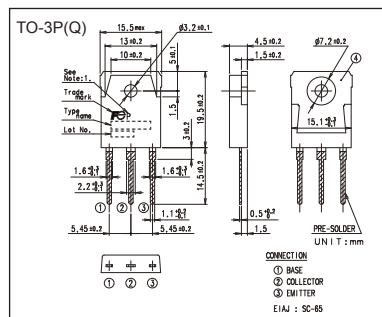
Features

- Maintains both low power loss and low noise
- Lower $R_{DS(on)}$ characteristic
- More controllable switching dv/dt by gate resistance
- Smaller V_{GS} ringing waveform during switching
- Narrow band of the gate threshold voltage ($3.0 \pm 0.5V$)
- High avalanche durability

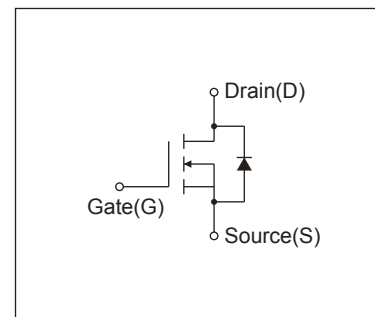
Applications

- Switching regulators
- UPS (Uninterruptible Power Supply)
- DC-DC converters

Outline Drawings [mm]



Equivalent circuit schematic



Maximum Ratings and Characteristics

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

Description	Symbol	Characteristics	Unit	Remarks
Drain-Source Voltage	V_{DS}	500	V	
	V_{DSX}	500	V	$V_{GS} = -30V$
Continuous Drain Current	I_D	± 23	A	
Pulsed Drain Current	I_{DP}	± 92	A	
Gate-Source Voltage	V_{GS}	± 30	V	
Repetitive and Non-Repetitive Maximum Avalanche Current	I_{AR}	23	A	Note*1
Non-Repetitive Maximum Avalanche Energy	E_{AS}	767.3	mJ	Note*2
Repetitive Maximum Avalanche Energy	E_{AR}	31.5	mJ	Note*3
Peak Diode Recovery dV/dt	dV/dt	9.3	kV/ μs	Note*4
Peak Diode Recovery $-di/dt$	$-di/dt$	100	A/ μs	Note*5
Maximum Power Dissipation	P_D	2.50	W	$T_a = 25^\circ C$
		315		$T_c = 25^\circ C$
Operating and Storage	T_{ch}	150	$^\circ C$	
Temperature range	T_{slg}	-55 to + 150	$^\circ C$	

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

Description	Symbol	Conditions	min.	typ.	max.	Unit
Drain-Source Breakdown Voltage	BV_{DSS}	$I_D = 250 \mu A, V_{GS} = 0V$	500	-	-	V
Gate Threshold Voltage	$V_{GS(th)}$	$I_D = 250 \mu A, V_{DS} = V_{GS}$	2.5	3.0	3.5	V
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = 500V, V_{GS} = 0V, T_{ch} = 25^\circ C$	-	-	25	μA
		$V_{DS} = 400V, V_{GS} = 0V, T_{ch} = 125^\circ C$	-	-	250	
Gate-Source Leakage Current	I_{GSS}	$V_{GS} = \pm 30V, V_{DS} = 0V$	-	10	100	nA
Drain-Source On-State Resistance	$R_{DS(on)}$	$I_D = 11.5A, V_{GS} = 10V$	-	0.21	0.245	Ω
Forward Transconductance	g_{fs}	$I_D = 11.5A, V_{DS} = 25V$	14	28	-	S
Input Capacitance	C_{iss}	$V_{DS} = 25V$	-	3500	5250	pF
Output Capacitance	C_{oss}	$V_{GS} = 0V$	-	330	495	
Reverse Transfer Capacitance	C_{rss}	$f = 1MHz$	-	24	36	
Turn-On Time	$t_{d(on)}$	$V_{cc} = 300V$	-	24	36	ns
	t_r	$V_{GS} = 10V$	-	13	19.5	
Turn-Off Time	$t_{d(off)}$	$I_D = 11.5A$	-	150	225	
	t_f	$R_{GS} = 5.6\Omega$	-	20	30	
Total Gate Charge	Q_{th}	$V_{cc} = 250V, I_D = 23A, V_{GS} = 10V$	-	11	16.5	nC
	Q_{GS}		-	93	139.5	
Gate-Source Charge	Q_{GS}		-	24	36	
Gate-Drain Charge	Q_{GD}		-	30	45	
Avalanche Capability	I_{AV}	$L = 1.16mH, T_{ch} = 25^\circ C$	23	-	-	A
Diode Forward On-Voltage	V_{SD}	$I_F = 23A, V_{GS} = 0V, T_{ch} = 25^\circ C$	-	0.90	1.35	V
Reverse Recovery Time	t_{rr}	$I_F = 23A, V_{GS} = 0V$	-	0.5	-	μs
Reverse Recovery Charge	Q_{rr}	$-di/dt = 100A/\mu s, T_{ch} = 25^\circ C$	-	8	-	μC

Thermal Characteristics

Description	Symbol	Test Conditions	min.	typ.	max.	Unit
Thermal resistance	$R_{th(ch-c)}$	Channel to case			0.40	$^\circ C/W$
	$R_{th(ch-a)}$	Channel to ambient			50.0	$^\circ C/W$

Note *1 : $T_{ch} \leq 150^\circ C$

Note *2 : Stating $T_{ch} = 25^\circ C, I_{AS} = 10A, L = 14.1mH, V_{cc} = 50V, R_G = 50\Omega$

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

See to 'Avalanche Energy' graph.

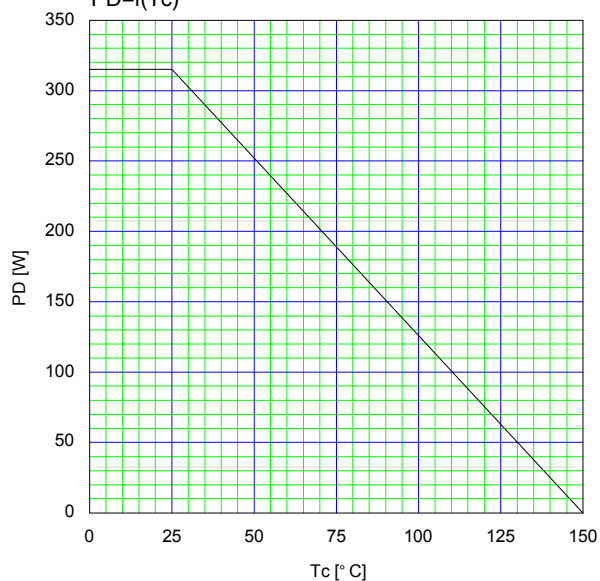
Note *3 : Repetitive rating : Pulse width limited by maximum channel temperature.

See to the 'Transient Thermal Impedance' graph.

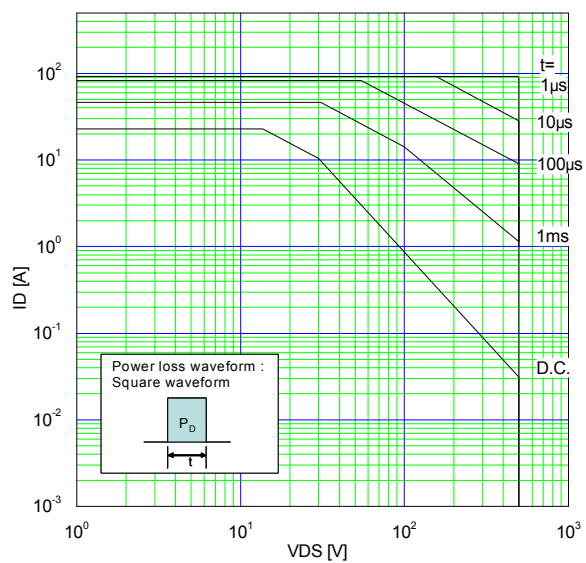
Note *4 : $I_F \leq I_D, -di/dt = 100A/\mu s, V_{cc} \leq BV_{DSS}, T_{ch} \leq 150^\circ C$.

Note *5 : $I_F \leq I_D, dv/dt = 5.0kV/\mu s, V_{cc} \leq BV_{DSS}, T_{ch} \leq 150^\circ C$.

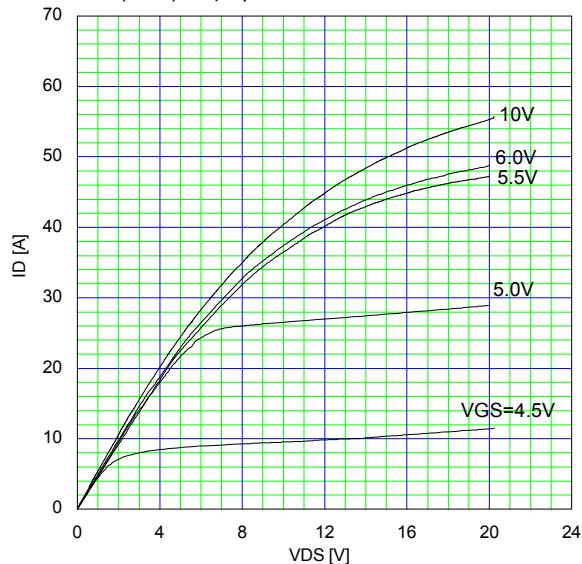
Allowable Power Dissipation
 $P_D = f(T_c)$



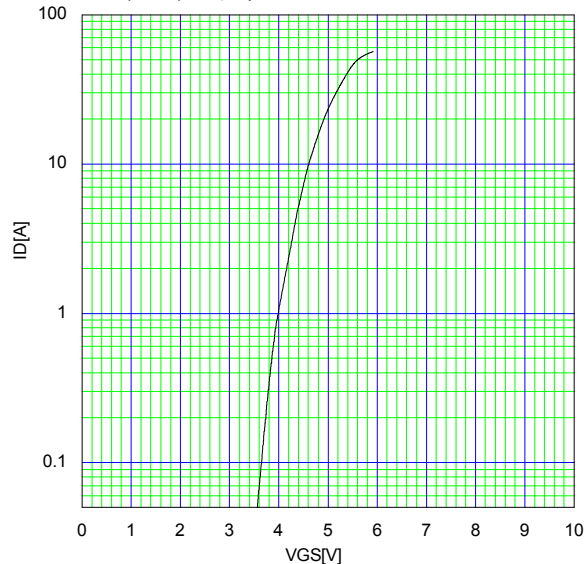
Safe Operating Area
 $I_D = f(V_{DS})$: Duty=0 (Single pulse), $T_c = 25^\circ\text{C}$



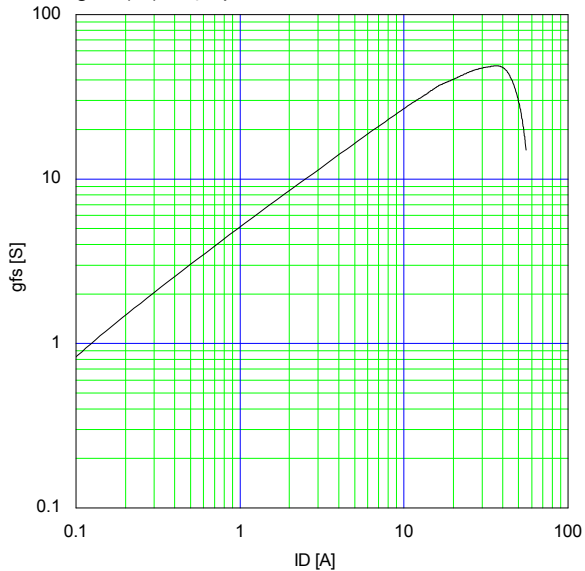
Typical Output Characteristics
 $I_D = f(V_{DS})$: 80 μs pulse test, $T_{ch} = 25^\circ\text{C}$



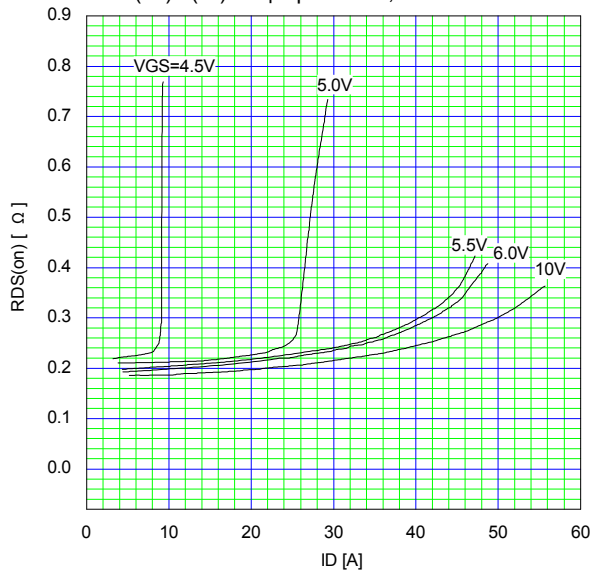
Typical Transfer Characteristic
 $I_D = f(V_{GS})$: 80 μs pulse test, $V_{DS} = 25\text{V}$, $T_{ch} = 25^\circ\text{C}$



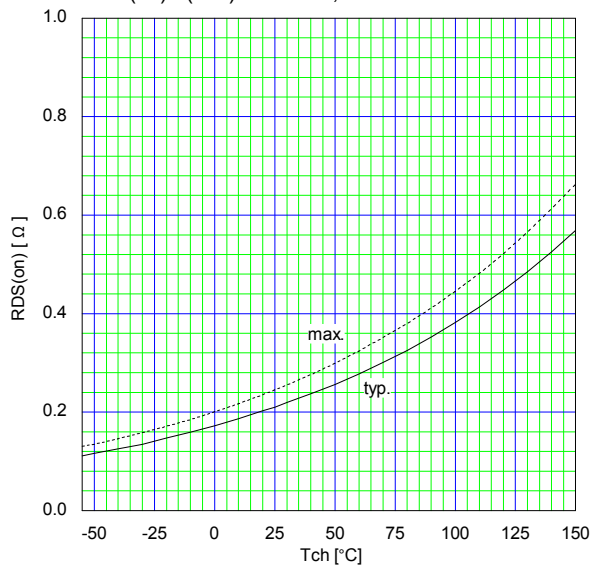
Typical Transconductance
 $g_{fs} = f(I_D)$: 80 μs pulse test, $V_{DS} = 25\text{V}$, $T_{ch} = 25^\circ\text{C}$



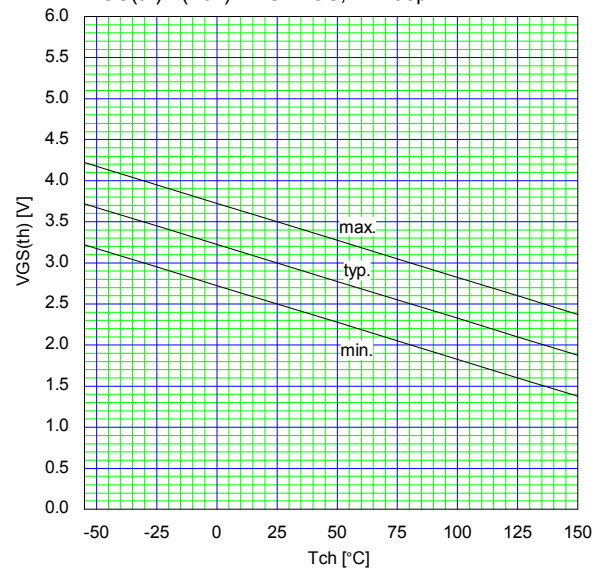
Typical Drain-Source on-state Resistance
 $R_{DS(on)} = f(I_D)$: 80 μs pulse test, $T_{ch} = 25^\circ\text{C}$



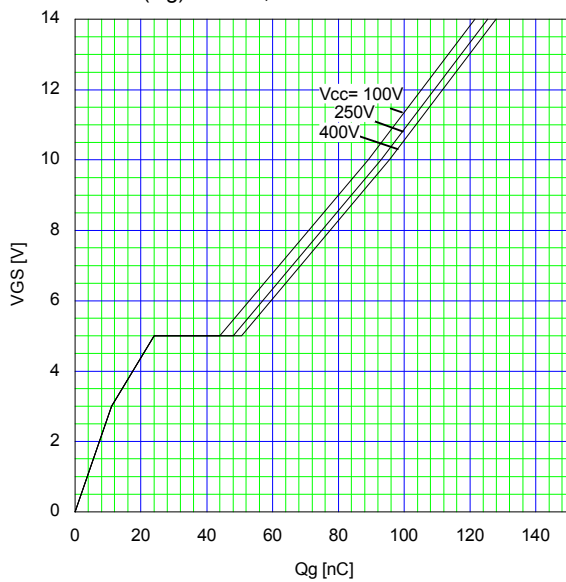
Drain-Source On-state Resistance
 $R_{DS(on)} = f(T_{ch}): I_D = 11.5A, V_{GS} = 10V$



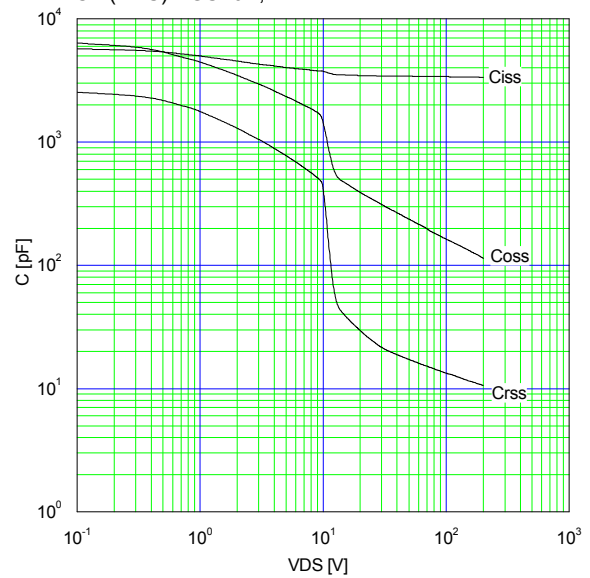
Gate Threshold Voltage vs. T_{ch}
 $V_{GS(th)} = f(T_{ch}): V_{DS} = V_{GS}, I_D = 250\mu A$



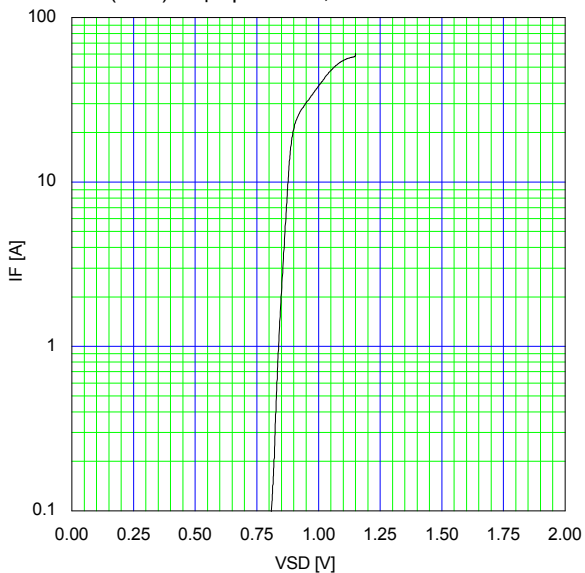
Typical Gate Charge Characteristics
 $V_{GS} = f(Q_g): I_D = 23A, T_{ch} = 25^{\circ}C$



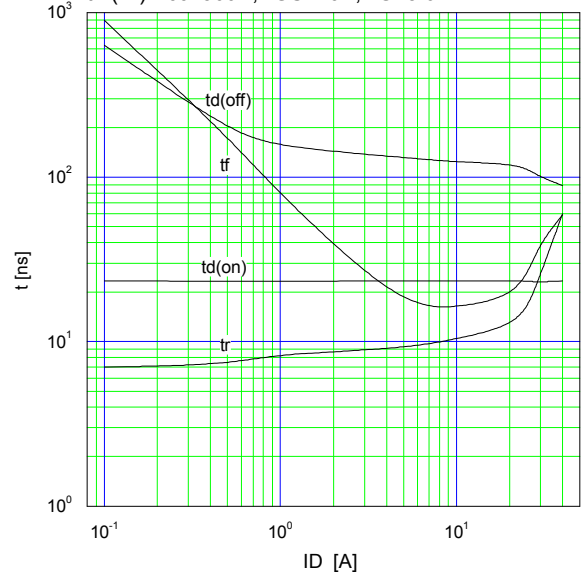
Typical Capacitance
 $C = f(V_{DS}): V_{GS} = 0V, f = 1MHz$



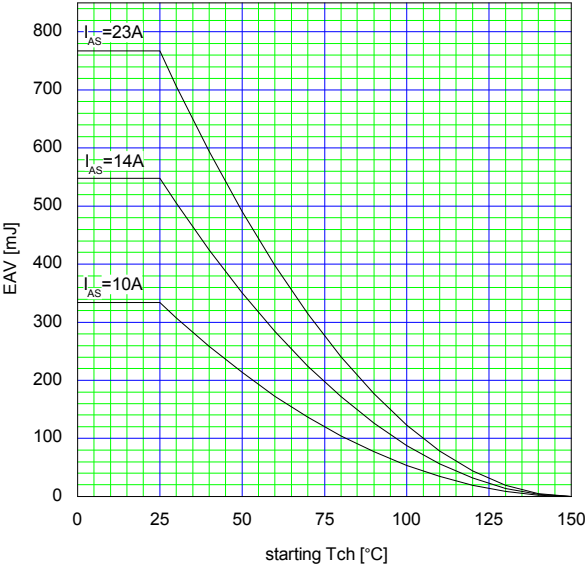
Typical Forward Characteristics of Reverse Diode
 $I_F = f(V_{SD}): 80\mu s$ pulse test, $T_{ch} = 25^{\circ}C$



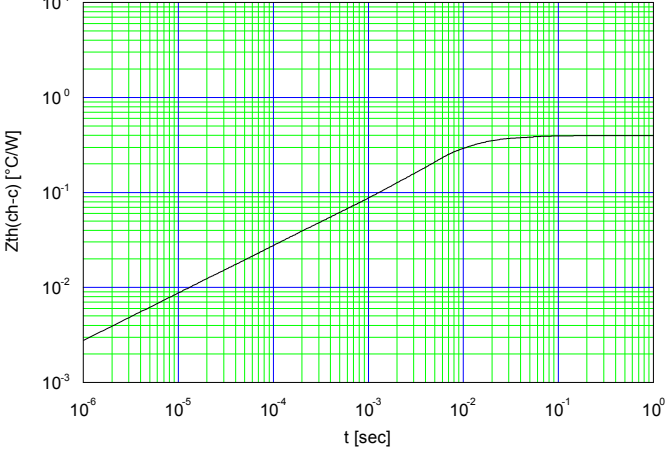
Typical Switching Characteristics vs. I_D
 $t = f(I_D): V_{CC} = 300V, V_{GS} = 10V, R_G = 5.6\Omega$



Maximum Avalanche Energy vs. starting Tch
 $E(AV)=f(\text{starting Tch}):V_{cc}=50V, I(AV)\leq 23A$



Maximum Transient Thermal Impedance
 $Z_{th}(ch-c)=f(t):D=0$



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