

# FMC11N60E

# Super FAP-E<sup>3</sup> series

### **N-CHANNEL SILICON POWER MOSFET**

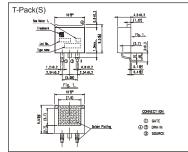
#### ■ Features

Maintains both low power loss and low noise Lower RDS(on) characteristic More controllable switching dv/dt by gate resistance Smaller V<sub>GS</sub> ringing waveform during switching Narrow band of the gate threshold voltage (3.0±0.5V) High avalanche durability

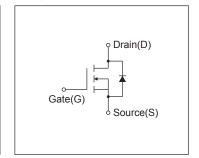
#### Applications

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

## ■ Outline Drawings [mm]



#### ■ Equivalent circuit schematic



#### ■ Maximum Ratings and Characteristics

#### ● Absolute Maximum Ratings at Tc=25°C (unless otherwise specified)

Description	Symbol	Characteristics	Unit	Remarks
Drain-Source Voltage	V <sub>DS</sub>	600	V	
Drain-Source voltage	V <sub>DSX</sub>	600	V	V <sub>GS</sub> = -30V
Continuous Drain Current	In	±11	Α	
Pulsed Drain Current	IDP	±44	Α	
Gate-Source Voltage	V <sub>G</sub> s	±30	V	
Repetitive and Non-Repetitive Maximum Avalanche Current	IAR	11	Α	Note*1
Non-Repetitive Maximum Avalanche Energy	Eas	384	mJ	Note*2
Repetitive Maximum Avalanche Energy	Ear	18.0	mJ	Note*3
Peak Diode Recovery dV/dt	dV/dt	4.9	kV/μs	Note*4
Peak Diode Recovery -di/dt	-di/dt	100	A/µs	Note*5
Maximum Power Dissipation	Po	1.67	W	Ta=25°C
		180	, vv	Tc=25°C
One wetting and Stepper Temperature was a	Tch	150	°C	
Operating and Storage Temperature range	T <sub>stg</sub>	-55 to + 150	°C	

#### Electrical Characteristics at Tc=25°C (unless otherwise specified)

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	I <sub>D</sub> =250μA, V <sub>GS</sub> =0V		-	-	V
Gate Threshold Voltage	V <sub>GS</sub> (th)	In=250µA, Vns=Vgs	In=250µA, Vns=Vs		3.0	3.5	V
Zero Gate Voltage Drain Current		V <sub>DS</sub> =600V, V <sub>GS</sub> =0V	Tch=25°C	-	-	25	μА
	IDSS	V <sub>DS</sub> =480V, V <sub>GS</sub> =0V	Tch=125°C	-	-	250	
Gate-Source Leakage Current	Igss	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V	V <sub>GS</sub> =±30V, V <sub>DS</sub> =0V		10	100	nA
Drain-Source On-State Resistance	R <sub>DS</sub> (on)	I <sub>D</sub> =5.5A, V <sub>GS</sub> =10V		-	0.64	0.75	Ω
Forward Transconductance	g <sub>fs</sub>	I <sub>D</sub> =5.5A, V <sub>DS</sub> =25V		6	12	-	S
Input Capacitance	Ciss	V <sub>DS</sub> =25V V <sub>GS</sub> =0V f=1MHz		-	1700	2550	pF
Output Capacitance	Coss			-	150	225	
Reverse Transfer Capacitance	Crss			-	11	16.5	
Turn-On Time	td(on)	V <sub>cc</sub> =300V V <sub>GS</sub> =10V I <sub>D</sub> =5.5A R <sub>G</sub> =15Ω		-	21	31.5	ns
	tr			-	9.5	14.3	
Turn-Off Time	td(off)			-	100	150	
	tf			-	19	28.5	
Total Gate Charge	Q <sub>G</sub>	1.00 0001		-	48.5	73	nC
Gate-Source Charge	Q <sub>GS</sub>			-	12.5	19	
Gate-Drain Charge	Q <sub>GD</sub>			14	21		
Avalanche Capability	lav	L=2.64mH, Tch=25°C	L=2.64mH, Tch=25°C		-	-	Α
Diode Forward On-Voltage	V <sub>SD</sub>	I <sub>F</sub> =11A, V <sub>GS</sub> =0V, T <sub>ch</sub> =25°C		-	0.86	1.30	V
Reverse Recovery Time	trr	I <sub>F</sub> =11A, V <sub>GS</sub> =0V		-	0.52	-	μs
Reverse Recovery Charge	Qrr	-di/dt=100A/μs, Tch=25°C		-	5.5	-	μC

#### Thermal Characteristics

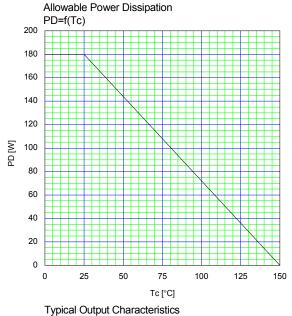
Description	Symbol	Test Conditions	min.	typ.	max.	Unit
Thermal resistance	Rth (ch-c)	Channel to case			0.690	°C/W
	Rth (ch-a)	Channel to ambient			75.0	°C/W

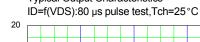
Note \*1 : Tch≤150°C

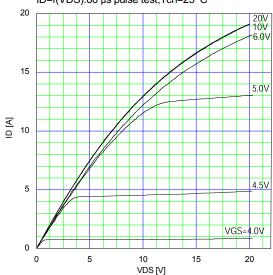
Note \*2 : Stating Tch=25°C, Ias=5A, L=28.2mH, Vcc=60V, Rg=50 $\Omega$ Eas limited by maximum channel temperature and avalanche current. See to 'Avalanche Energy' graph.

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

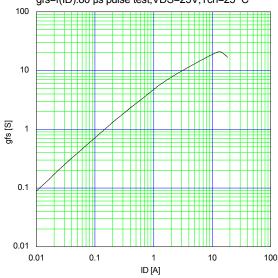
See to the 'Transient Themal impeadance' graph. Note \*4 : IFS-ID, -di/dt=100A/µs, Vcc≤BVbss, Tch≤150°C. Note \*5 : Ir≤-Ip, dv/dt=4.4kV/µs, Vcc≤BVpss, Tch≤150°C.

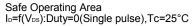


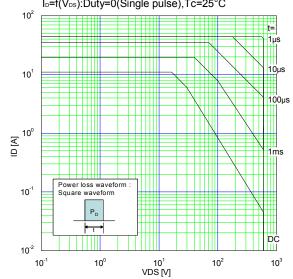




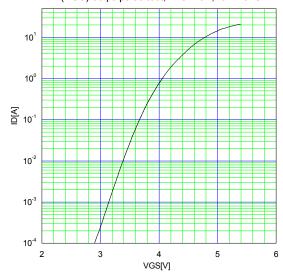
Typical Transconductance gfs=f(ID):80 µs pulse test,VDS=25V,Tch=25 °C



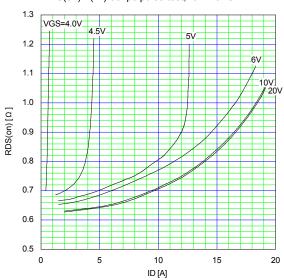


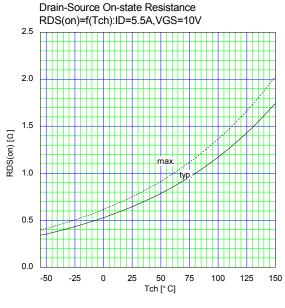


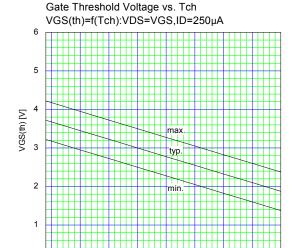
Typical Transfer Characteristic ID=f(VGS):80 µs pulse test,VDS=25V,Tch=25 °C



Typical Drain-Source on-state Resistance RDS(on)=f(ID):80 µs pulse test,Tch=25 °C





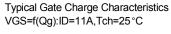


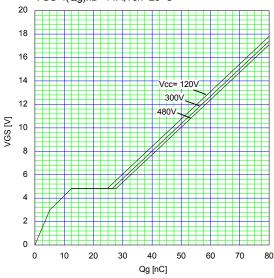
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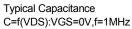
Tch [°C]

125

150



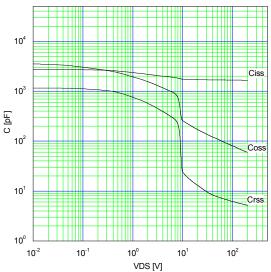




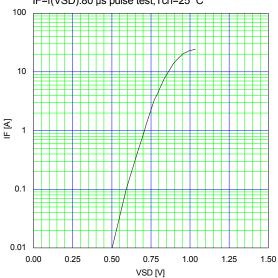
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-50

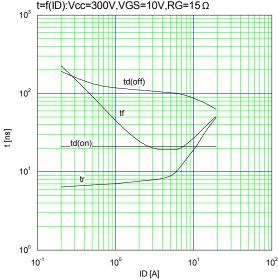
-25

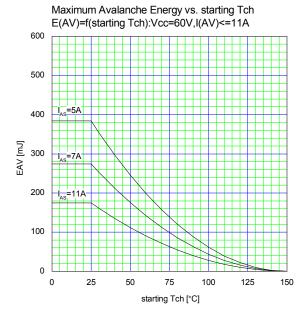


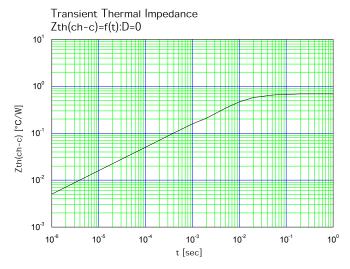
Typical Forward Characteristics of Reverse Diode IF=f(VSD):80  $\mu$ s pulse test,Tch=25  $^{\circ}$ C



Typical Switching Characteristics vs. ID t=f(ID): $Vcc=300V,VGS=10V,RG=15\Omega$ 







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