

FMOSCP E54N120-Q1-H

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FMOSCP E54N120-Q1-H

54A 1200V N-Channel Silicon Carbide Enhancement Mode Power MOSFET

Features

- $V_{DS}=1200V$, $I_D=54A$.
- $R_{DS(ON)} \leq 56m\Omega$, @ $V_{GS}=18V$, $I_D=20A$.
- Optimized on-resistance with rapid switching behavior.
- Compatible with standard gate drivers.
- High avalanche endurance capability.
- Clean kelvin-source switching pin-out (4L type).
- 8mm of drain to source creepage distance (4L type).
- Qualified to AEC-Q101 standards for high reliability.
- Lead-free parts meet RoHS requirements.
- Halogen-free (IEC61249-2-21).

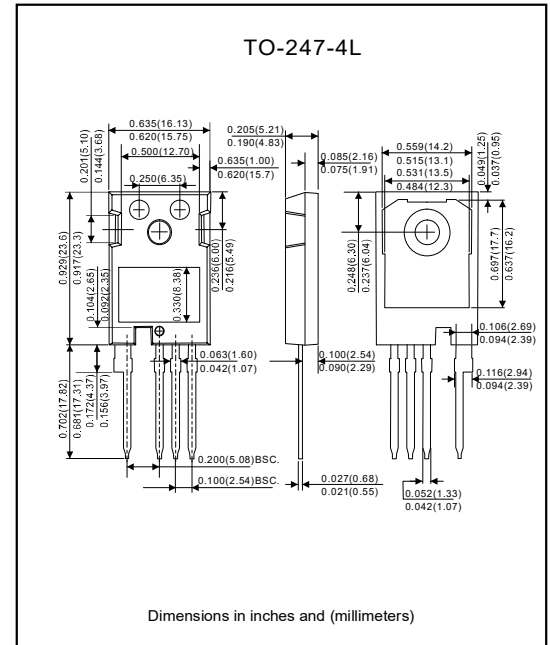
Applications

- Switching mode power supply, PFC and DC/DC converter.
- EV charging station, UPS and renewable energy.
- Power inverter and motor driver.

Mechanical data

- Epoxy : UL94-V0 rated flame retardant.
- Case : Molded plastic, TO-247-4L.
- Terminals : Solder plated, solderable per MIL-STD-750, Method 2026.
- Weight : Approximated 6.78g.

Package outline



Maximum ratings (At $T_J=25^\circ C$ unless otherwise specified)

Parameter	Conditions	Symbol	Min	Typ	Max	Unit
Minimum drain to source voltage	$V_{GS}=0V$, $I_D=5mA$	V_{DS}	1200			V
Operate gate to source voltage (Recommended operating values)		$V_{GS_Op.}$	-8~0		15~18	V
Transient gate to source voltage (Transient operating limit)	AC $f > 1Hz$, pulse width < 100ns	$V_{GS_Tran.}$	-10		22	V
Continuous drain current	$V_{GS}=18V$, $T_c=25^\circ C$	I_D			54	A
	$V_{GS}=18V$, $T_c=100^\circ C$				40	
Pulsed drain current	per fig.13	I_{DM}			152	A
Continuous body diode current	$V_{GS}=0V$, $T_c=25^\circ C$	I_S			45	A
Avalanche energy, single pulse	$L=25mH$	E_{AS}			800	mJ
Power dissipation	$T_c=25^\circ C$	P_D			278	W
Thermal resistance, junction to ambient	Device on PCB, with $6cm^2$ of cooling area	$R_{\theta JA}$		40		$^\circ C/W$
Thermal resistance, junction to case		$R_{\theta JC}$		0.54		$^\circ C/W$
Soldering temperature		T_L			260	$^\circ C$
Junction temperature range		T_J	-55		+175	$^\circ C$
Storage temperature range		T_{STG}	-55		+175	$^\circ C$

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Electrical characteristics (At $T_J=25^{\circ}\text{C}$ unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Off characteristics						
Drain-source breakdown voltage	BV _{DSS}	I _D =5mA, V _{GS} =0V, T _J =25°C	1200			V
		I _D =5mA, V _{GS} =0V, T _J =175°C		1200		
Drain-source leakage current	I _{DSS}	V _{DS} =1200V, V _{GS} =0V		2	500	μA
Gate-source leakage current	I _{GSS}	V _{GS} =18V, V _{DS} =0V			100	nA
On characteristics						
Gate threshold voltage	V _{GS(TH)}	V _{DS} =V _{GS} , I _D =40mA		2.2		V
Static drain-source on-state resistance	R _{DS(ON)}	V _{GS} =18V, I _D =20A, T _J =25°C		40	56	mΩ
		V _{GS} =18V, I _D =20A, T _J =175°C		68		
Dynamic parameters						
Input capacitance	C _{iss}	V _{GS} =0V, V _{DS} =800V, f=250kHz, V _{AC} =25mV		3129		pF
Out capacitance	C _{oss}			95		
Reverse capacitance	C _{rss}			13		
Effective output capacitance, energy related (Note1)	C _{o(er)}			123		
Effective output capacitance, time related (Note2)	C _{o(tr)}			175		
C _{OSS} Stored energy	E _{OSS}	V _{GS} =0V, V _{DS} =800V, f=250kHz, V _{AC} =25mV		39		μJ
Output capacitive charge	Q _{oss}	V _{GS} =0V, V _{DS} =800V, f=250kHz, V _{AC} =25mV		140		nC
Gate-source charge	Q _{GS}	V _{GS} =0V/15V, V _{DS} =800V, I _D =40A		22		nC
Gate-drain charge	Q _{GD}			52		
Total gate charge	Q _G			117		
Internal gate resistance	R _{G_int.}	f=1.0MHz, V _{AC} =25mV		2.4		Ω
Inductive load						
Turn on delay time	t _{d(on)}	V _{GS} =-3/+15V, V _{DS} =800V, I _D =35A, R _{G(ext.)} =2.7Ω, External SiC diode as an FWD		47		ns
Rise time	t _r			52		
Turn off delay time	t _{d(off)}			28		
Fall time	t _f			11		
Turn on switching energy	E _{on}			739		μJ
Turn off switching energy	E _{off}			61		

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Electrical characteristics (At $T_J=25^\circ\text{C}$ unless otherwise specified)

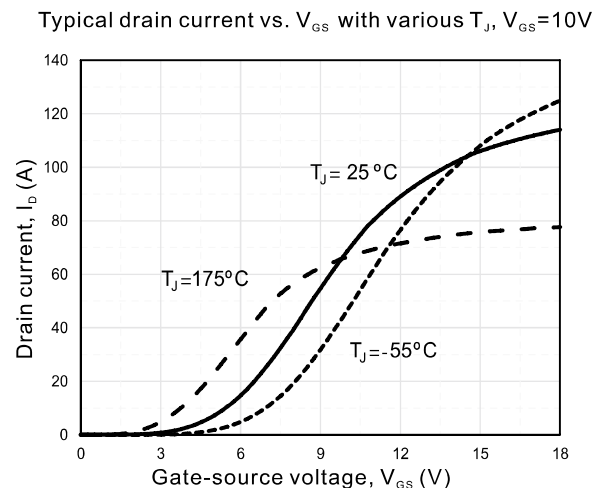
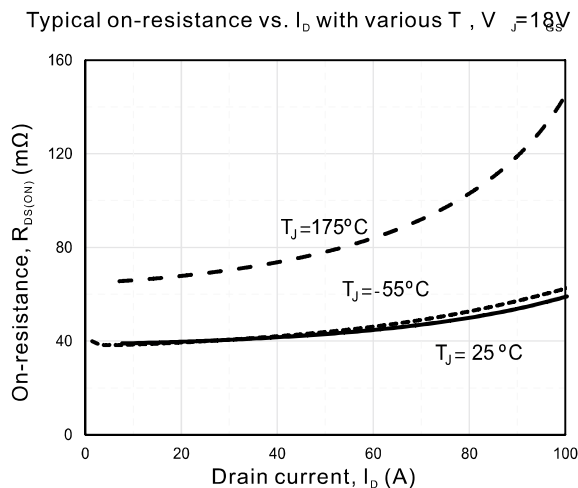
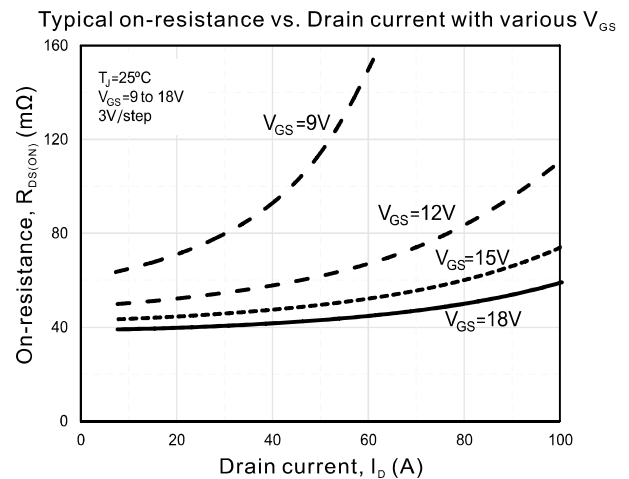
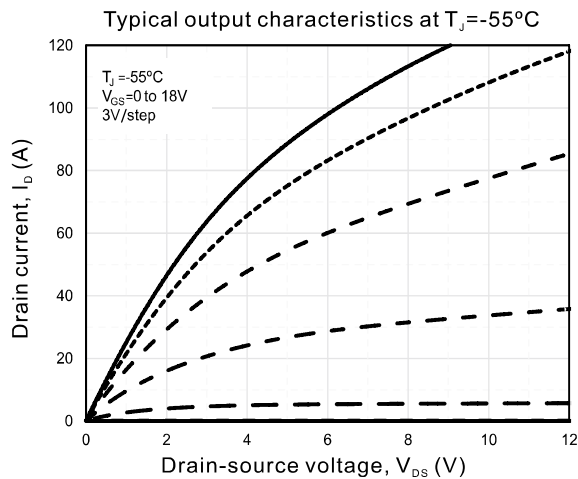
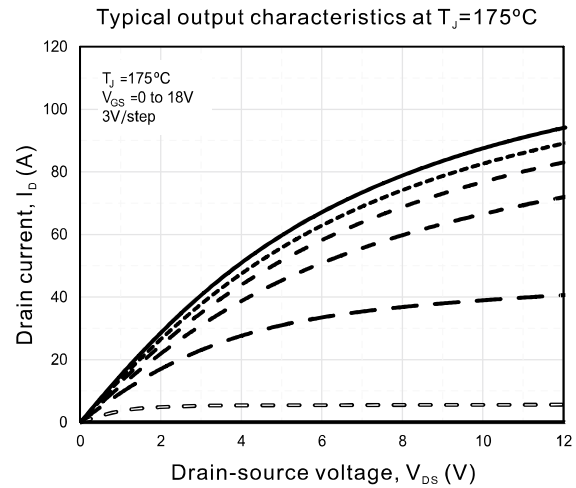
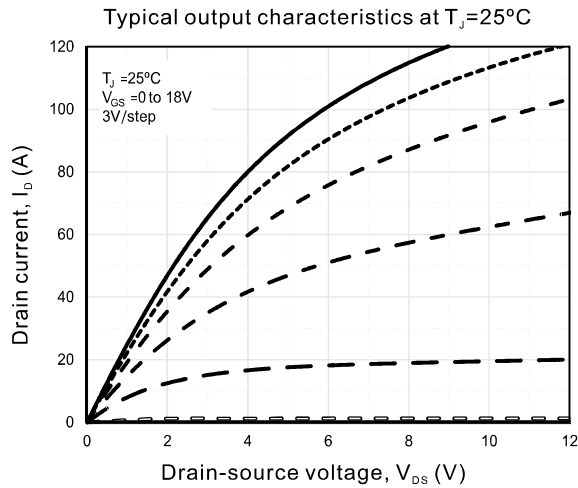
Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Resistive load						
Turn on delay time	t _{d(on)}	V _{GS} =-3/+15V, V _{DS} =800V, I _D =26A, R _{G_on(ext.)} =2.7Ω, R _{G_off(ext.)} =1Ω, R _L =30Ω		22		nS
Rise time	t _r			29		
Turn off delay time	t _{d(off)}			32		
Fall time	t _f			11		
Body diode characteristics						
Diode forward voltage	V _{SD}	I _S =15A, V _{GS} =0V, T _J =25°C		3.1		V
		I _S =15A, V _{GS} =0V, T _J =175°C		3.0		
Peak reverse recovery current	I _{rrm}	I _S =30A, V _{GS} =0V, V _{DS} =400V, di/dt=300A/μs, *Q _{rr} herein excluded the Q _{oss} value.		3.0		A
Reverse recovery charge	Q _{rr}			98		nC
Reverse recovery time	t _{rr}			60		ns

Note: 1. $C_{O(er)}$ is a fixed capacitance that gives the same stored energy as C_{oss} while V_{DS} is rising from 0 to 800V.

2. $C_{O(er)}$ is a fixed capacitance that gives the same charging time as C_{oss} while V_{DS} is rising from 0 to 800V.

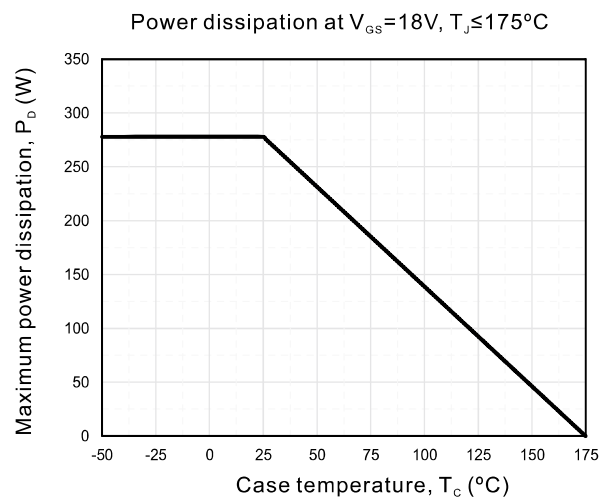
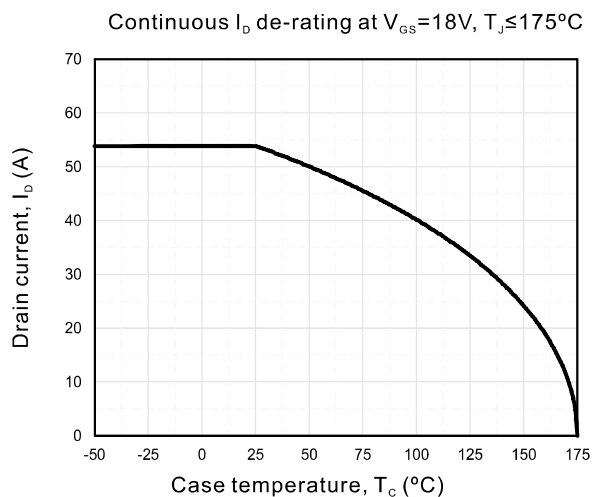
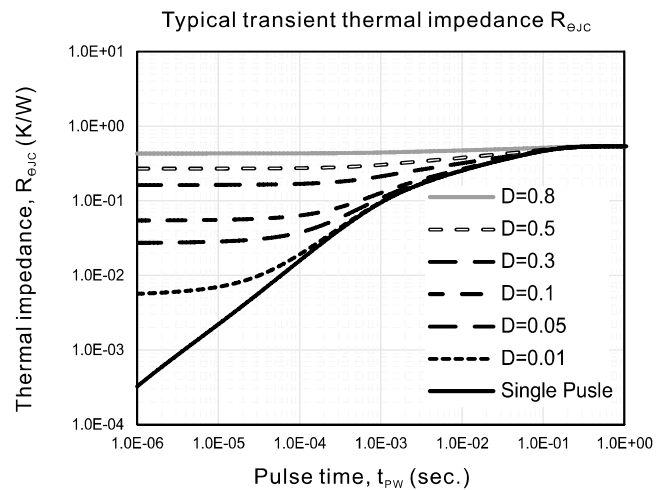
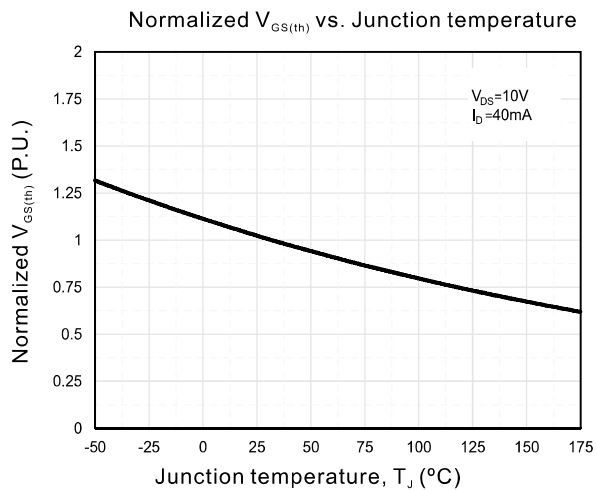
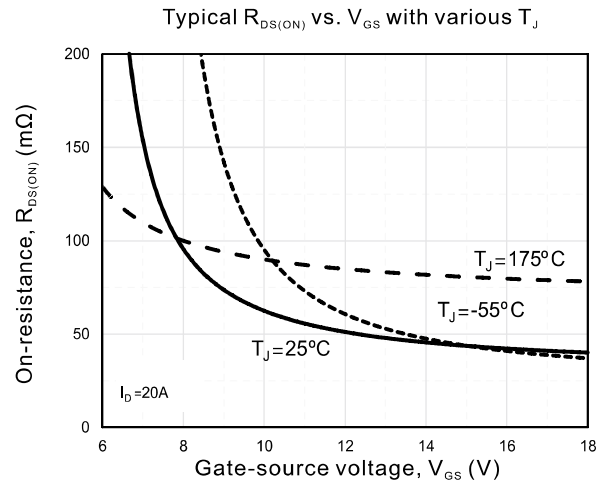
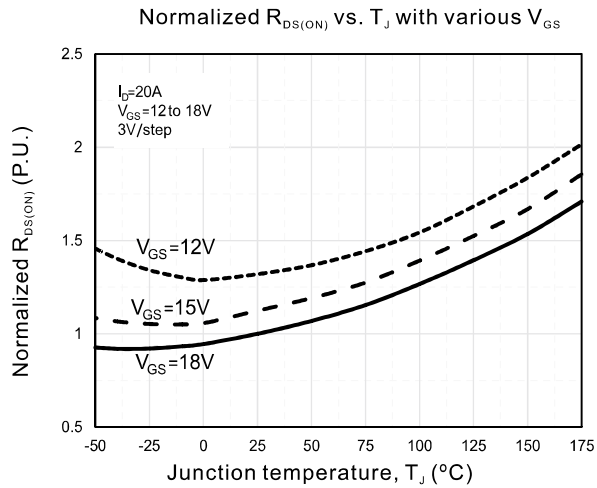
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Rating and characteristic curves



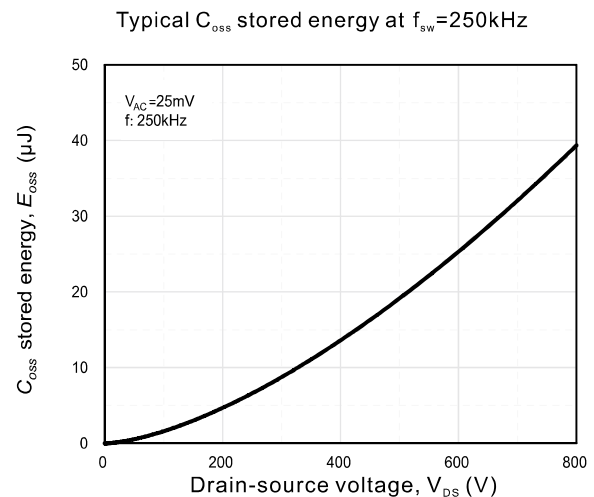
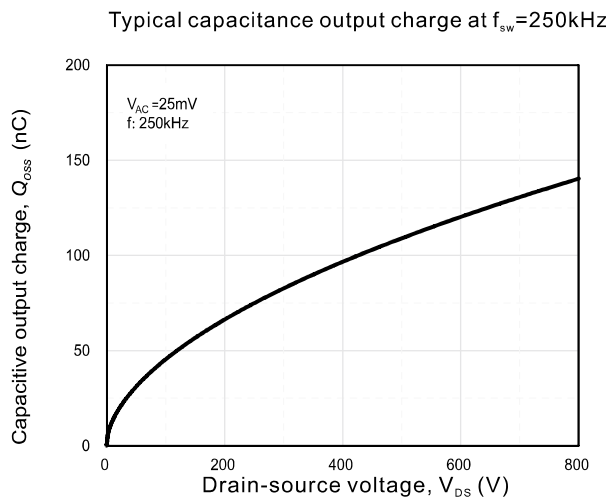
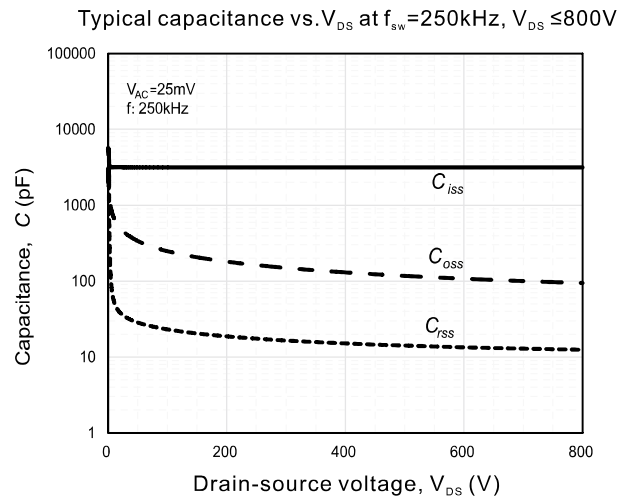
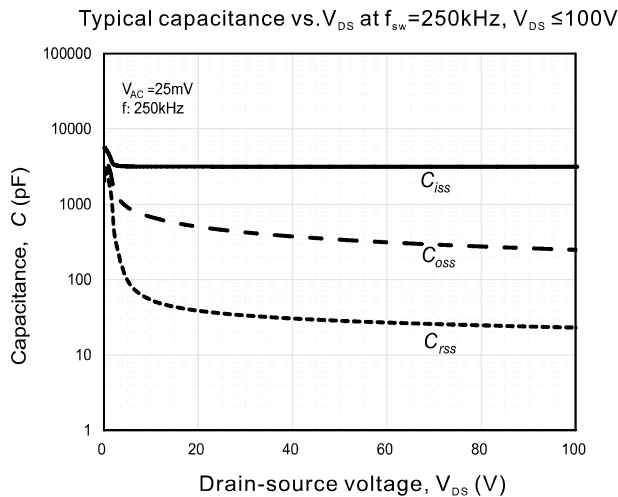
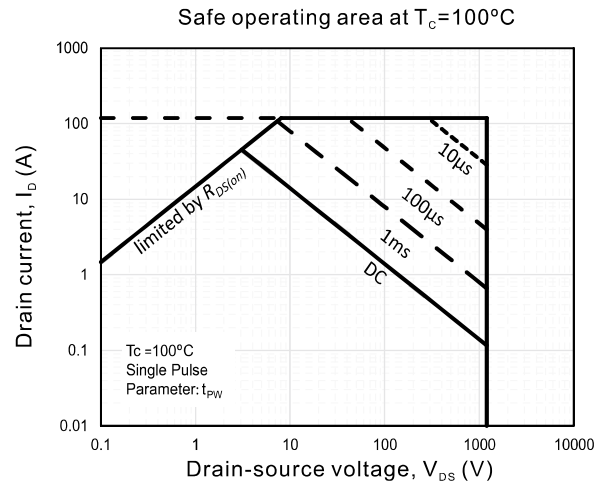
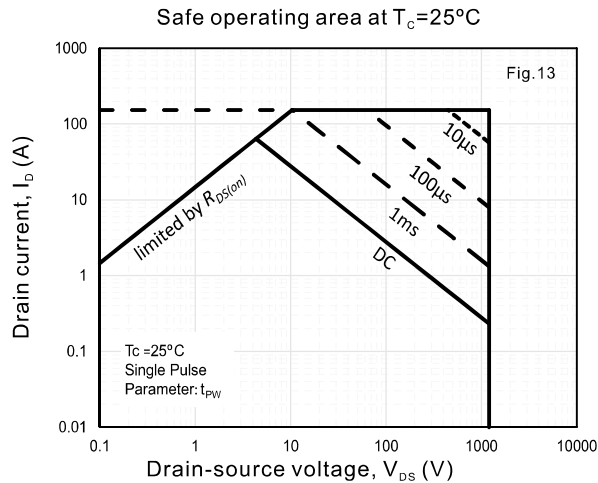
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Rating and characteristic curves



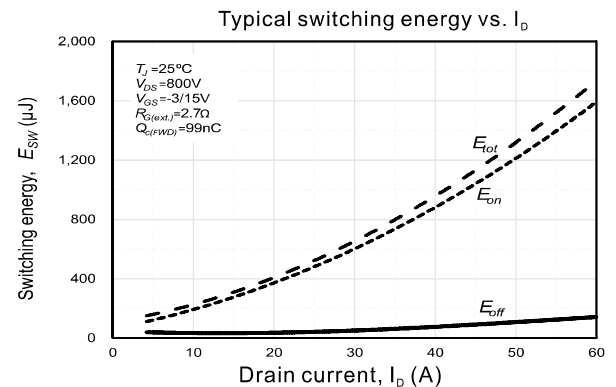
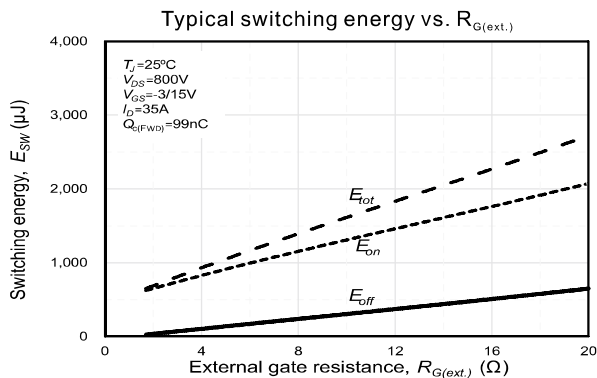
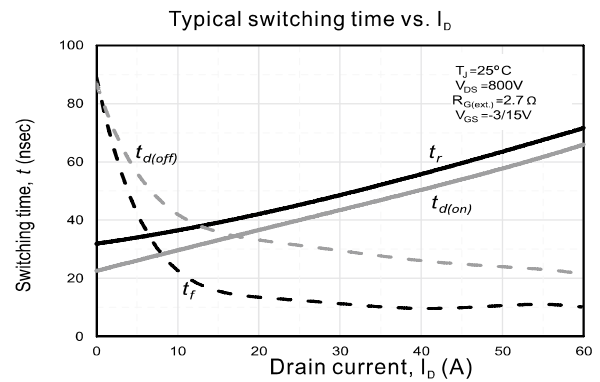
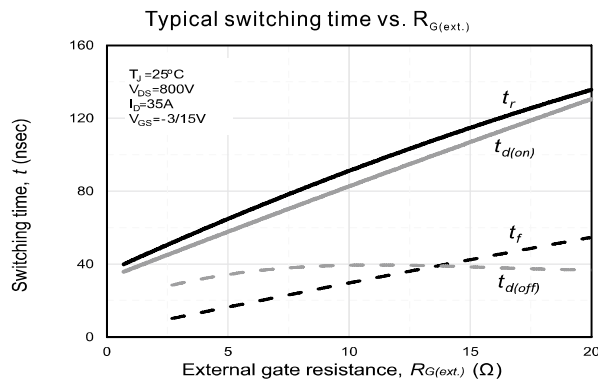
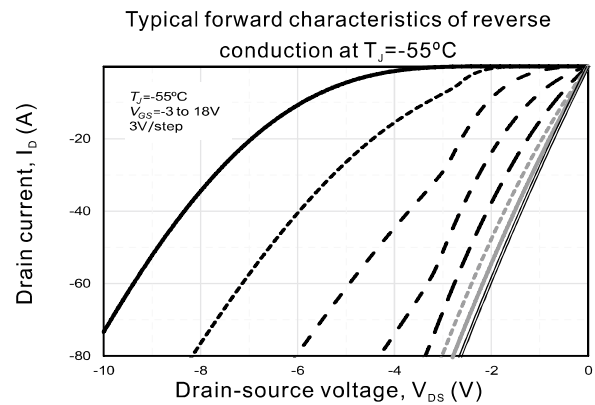
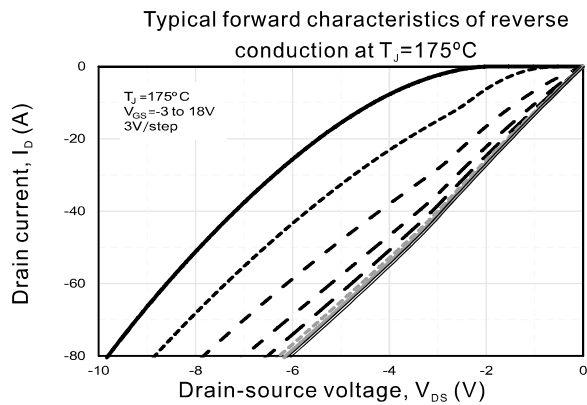
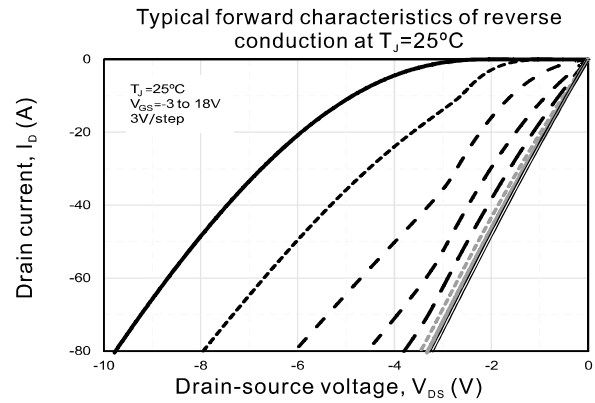
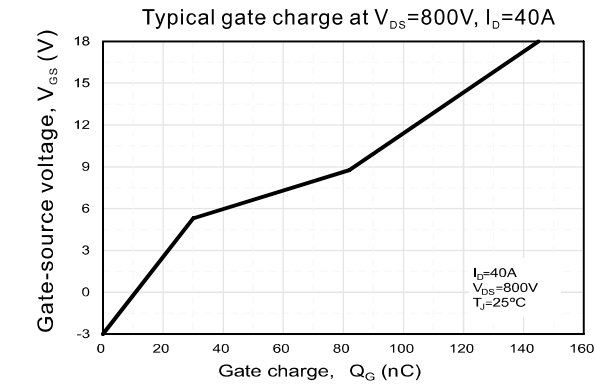
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Rating and characteristic curves



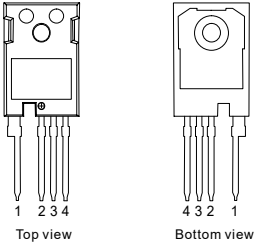
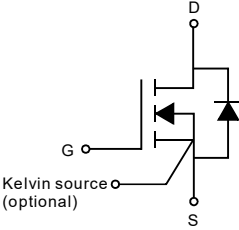
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Rating and characteristic curves



FMOSCPE54N120-Q1-H

Pinning information

Pin	Simplified outline	Symbol
Pin 1 Drain Pin 2 Source Pin 3 Kelvin source Pin 4 Gate	 Top view Bottom view	

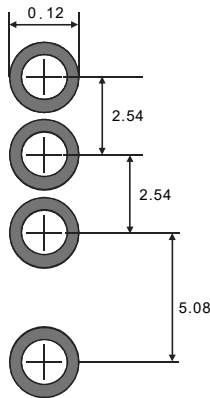
Marking

Type number	Marking code
FMOSCPE54N120-Q1-H	FMS CPE54N120 XXXYWW

*XXX: Lot ID or other information.
YYWW: Wafer lot code.
YY: Year
WW: Week

Suggested solder pad layout

TO-247-4L

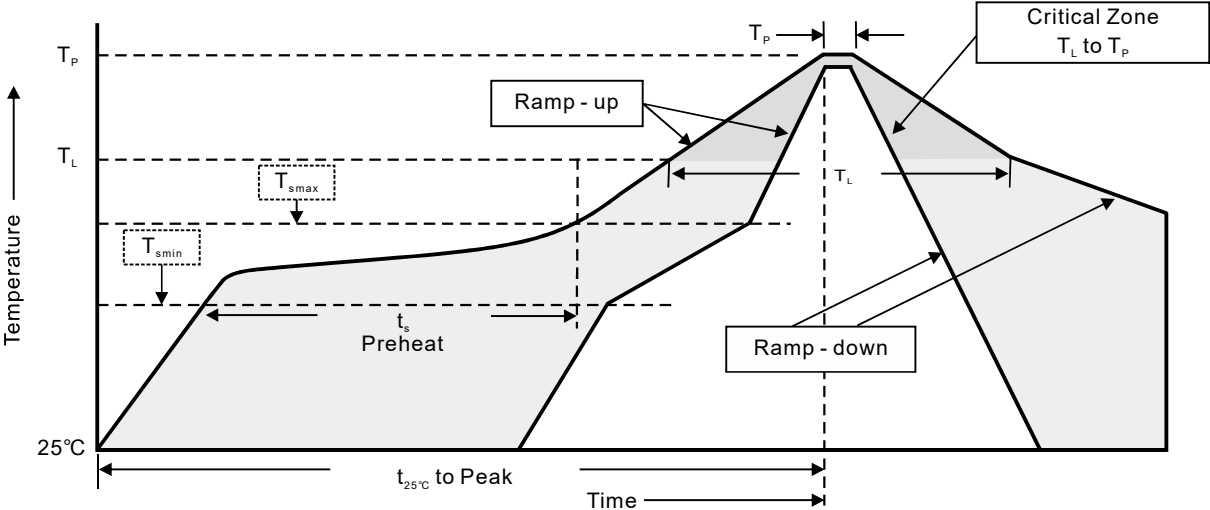


Dimensions in millimeters

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Suggested thermal profiles for soldering processes

- 1. Storage environment : Temperature = 5°C ~ 40°C, Humidity = 55%, ±25%.
- 2. Reflow soldering of surface - Mount devices.



3.Reflow soldering

Profile feature	Soldering condition
Average ramp-up rate (T_L to T_P)	< 3 °C/sec
Preheat - Temperature Min (T_{smin}) - Temperature Max (T_{smax}) - Time (Min to Max) (t_s)	150°C 200°C 60 ~ 120 sec
T_{smax} to T_L - Ramp-up rate	< 3 °C / sec
Time maintained above : - Temperature (T_L) - Time (T_L)	217°C 60 ~ 260 sec
Peak temperature (T_P)	255 °C -0 / +5°C
Time with 5°C of actual peak temperature (T_P)	10 ~ 30 sec
Ramp-down rate	< 6°C / sec
Time 25°C to peak temperature	< 6 minutes