

FMOSAC176N04-Q1-H

List

List.....1

Package outline.....2

Features.....2

Applications.....2

Mechanical data.....2

Maximum ratings2

Electrical characteristics.....3

Rating and characteristic curves.....4~6

Pinning information.....7

Marking.....7

Suggested solder pad layout.....7

Packing information.....8

Reel packing.....9

Suggested thermal profiles for soldering processes.....9

High reliability test capabilities.....10

FMOSAC176N04-Q1-H

222A 40V N-Channel
Enhancement Mode Power MOSFET

Features

- $V_{DS}=40V$, $I_D=222A$.
- $R_{DS(ON)} \leq 2.4m\Omega$, @ $V_{GS}=10V$, $I_D=20A$.
- $R_{DS(ON)} \leq 3.2m\Omega$, @ $V_{GS}=4.5V$, $I_D=15A$.
- Ultra-low on-resistance.
- Low gate charge.
- 100% UIS and 100% R_g tested.
- Qualified to AEC-Q101 standards for high reliability.
- Lead-free parts meet RoHS requirements.

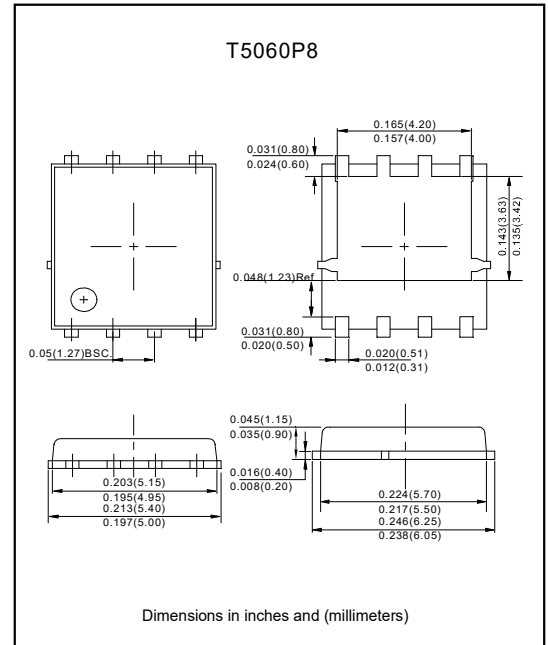
Applications

- Load switch.
- PWM application.
- General automotive application.

Mechanical data

- Epoxy:UL94-V0 rated flame retardant.
- Case : Molded plastic, T5060P8(DFN5060-8).
- Mounting Position : Any.

Package outline

Maximum ratings (At $T_c=25^\circ C$ unless otherwise noted)

Parameter	Symbol	Ratings	Unit
Drain-source voltage	V_{DS}	40	V
Gate-source voltage	V_{GS}	± 20	V
Continuous drain current $T_c=25^\circ C$ $T_c=100^\circ C$	I_D	222	A
		157	
Pulsed drain current (Note 1)	I_{DM}	Refer to Fig.4	A
Single pulse avalanche energy (Note 2)	E_{AS}	356	mJ
Power dissipation $T_c=25^\circ C$ $T_c=100^\circ C$	P_D	150	W
		75	
Thermal resistance, junction to ambient	$R_{\theta JA}$	42	$^\circ C/W$
Thermal resistance, junction to case	$R_{\theta JC}$	1	$^\circ C/W$
Junction temperature	T_J	+175	$^\circ C$
Storage temperature range	T_{STG}	-55 to +175	$^\circ C$

FMOSAC176N04-Q1-H

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

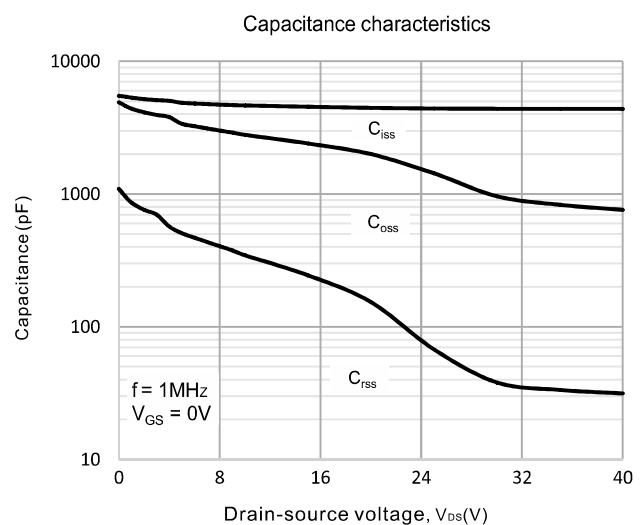
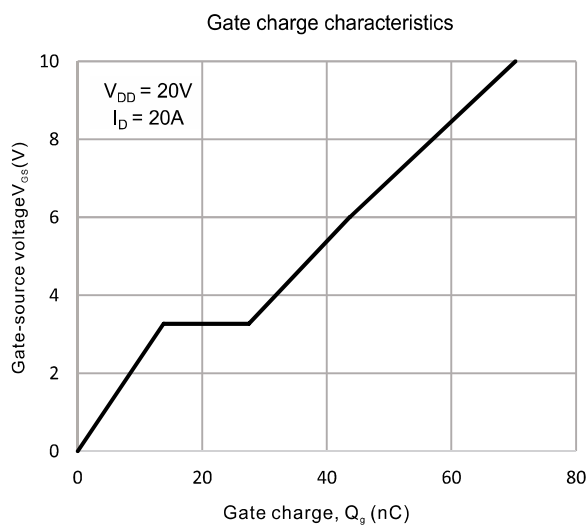
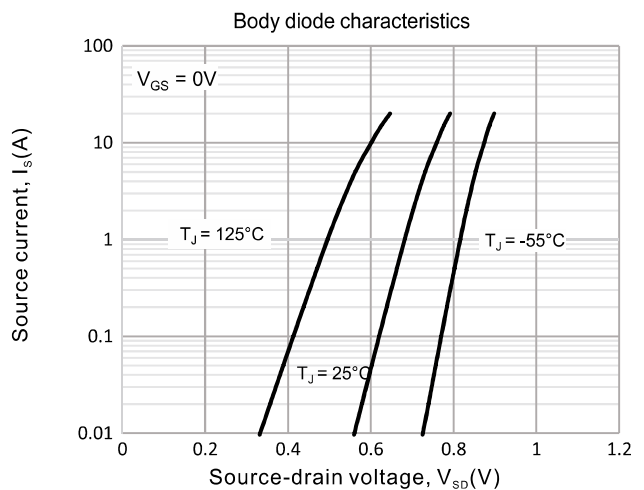
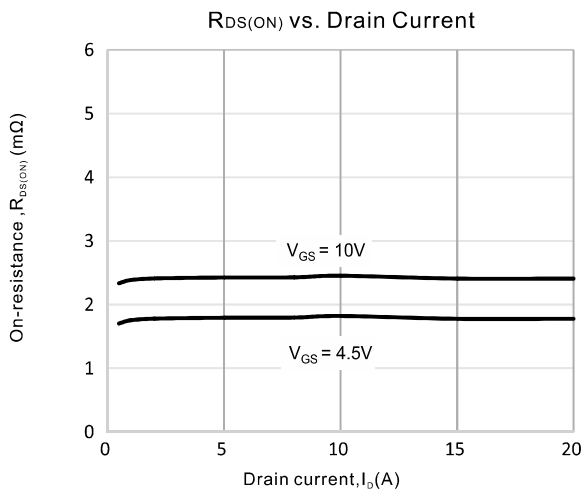
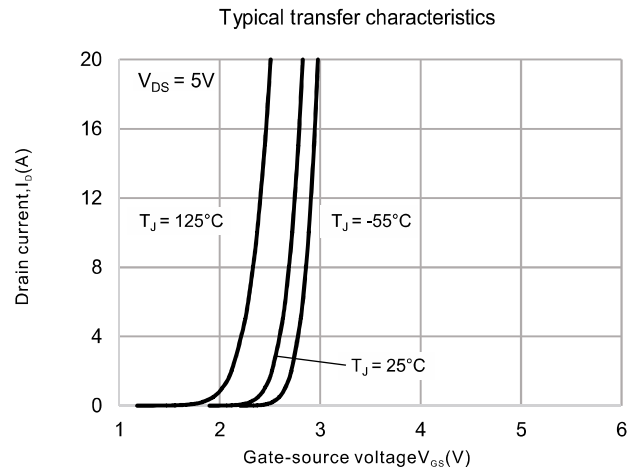
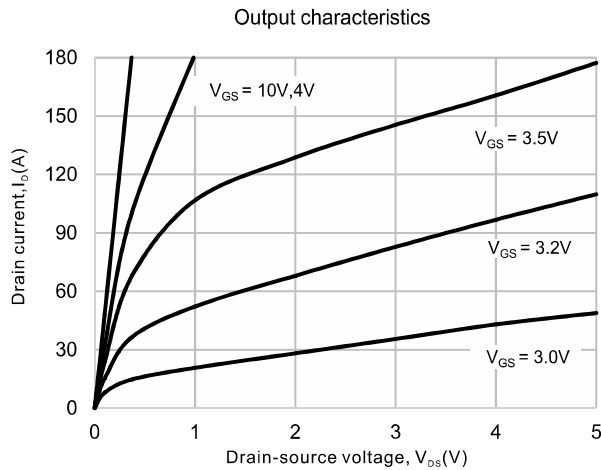
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Off characteristics						
Drain-source breakdown voltage	BV_{DSS}	$I_D=250\mu A$, $V_{GS}=0V$	40			V
Drain-source leakage current	I_{DSS}	$V_{DS}=32V$, $V_{GS}=0V$			1	μA
Gate-source leakage current	I_{GSS}	$V_{GS}=\pm 20V$, $V_{DS}=0V$			± 100	nA
On characteristics						
Gate threshold voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}$, $I_D=250\mu A$	1.3	1.9	2.4	V
Static drain-source on-resistance (Note 4)	$R_{DS(ON)}$	$V_{GS}=10V$, $I_D=20A$		1.8	2.4	m Ω
		$V_{GS}=4.5V$, $I_D=15A$		2.5	3.2	
Dynamic parameters						
Input capacitance	C_{iss}	$V_{GS}=0V$, $V_{DS}=20V$, $f=1.0MHz$	3184	4458	6018	pF
Out capacitance	C_{oss}		1429	2000	2700	
Reverse transfer capacitance	C_{rss}		110	154	208	
Gate resistance	R_g	$f=1.0MHz$		1		Ω
Switching parameters						
Total gate charge	Q_g	$V_{GS}=0$ to $10V$, $V_{DS}=20V$, $I_D=20A$	50	70	95	nC
Gate to source charge	Q_{gs}		10	14	19	
Gate to drain charge	Q_{gd}		10	14	18	
Turn-on delay time	$t_{d(on)}$	$V_{DD}=20V$, $V_{GS}=10V$, $R_g=3\Omega$, $I_D=20A$		15		ns
Rise time	t_r			26		
Turn-off delay time	$t_{d(off)}$			47		
Fall time	t_f			14		
Source-drain diode ratings and characteristics						
Drain-source diode forward voltage	V_{SD}	$I_S=20A$, $V_{GS}=0V$			1.2	V
Maximum body-diode continuous current	I_S				222	A
Maximum pulsed body diode forward current	I_{SM}				887	V
Body diode reverse recovery time	t_{rr}	$I_F=20A$, $dI/dt=100A/\mu s$	38	53	72	ns
Body diode reverse recovery charge	Q_{rr}			65		nC

Notes : 1. Repetitive rating: pulse width limited by maximum junction temperature.

2. E_{AS} condition: starting $T_J=25^{\circ}\text{C}$, $V_{DD}=20\text{V}$, $V_G=10\text{V}$, $R_G=25\Omega$, $L=3\text{mH}$, $I_{AS}=15.4\text{A}$, $V_{DD}=0\text{V}$ during time in avalanche.3. $R_{\theta JA}$ is measured with the device mounted on a 1inch² pad of 2oz copper FR4 PCB.4. Pulse test: pulse width $\leq 300\mu\text{s}$, duty cycle $\leq 0.5\%$.

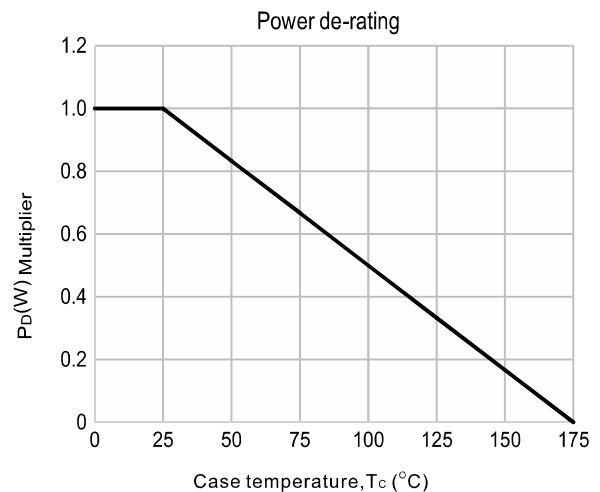
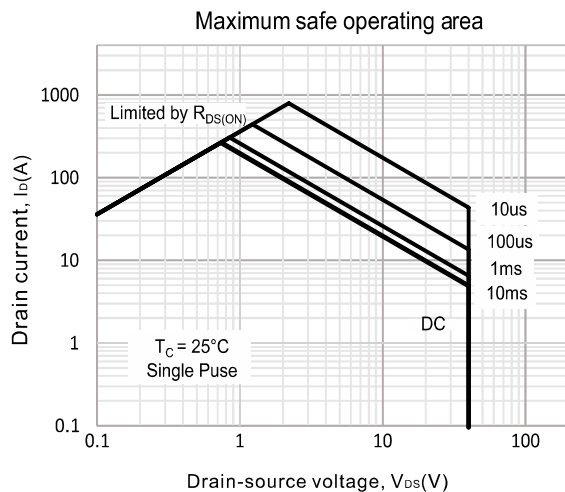
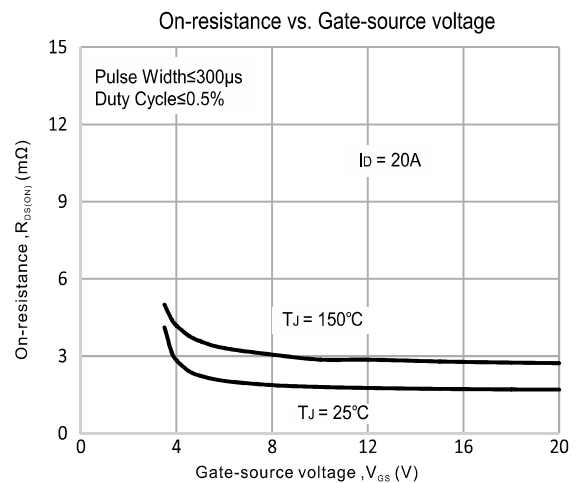
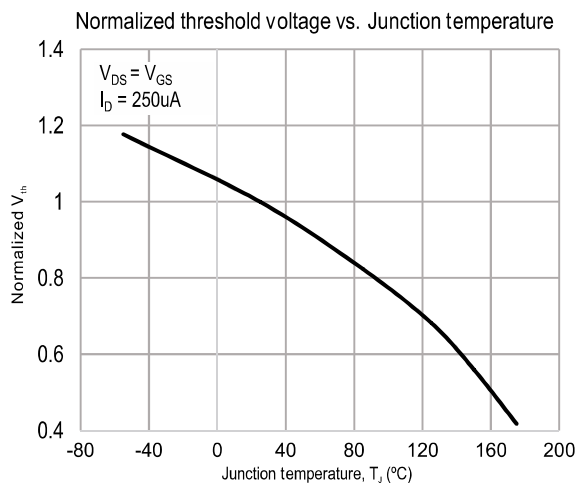
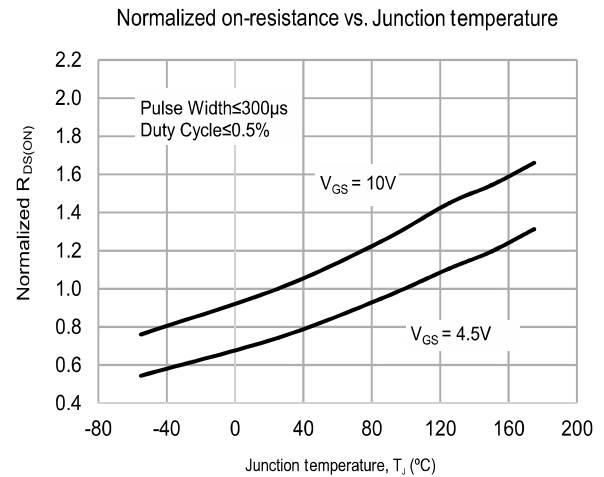
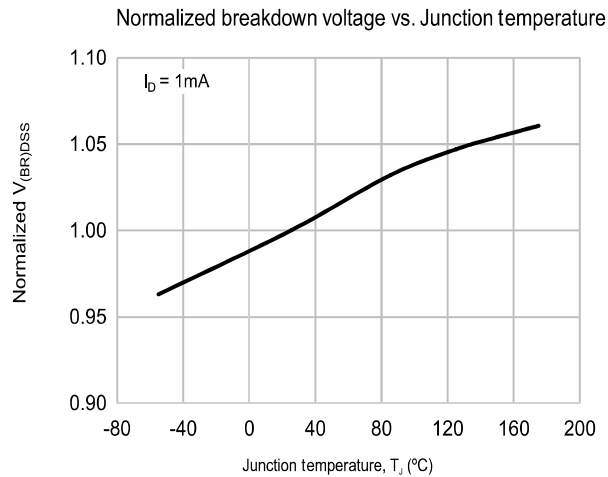
FMOSAC176N04-Q1-H

Rating and characteristic curves



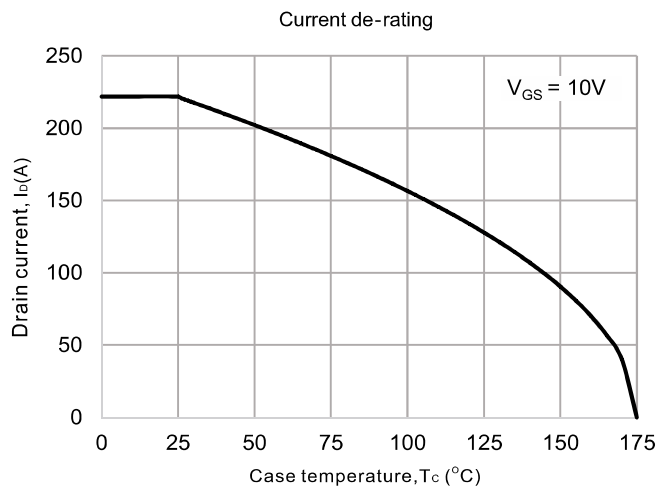
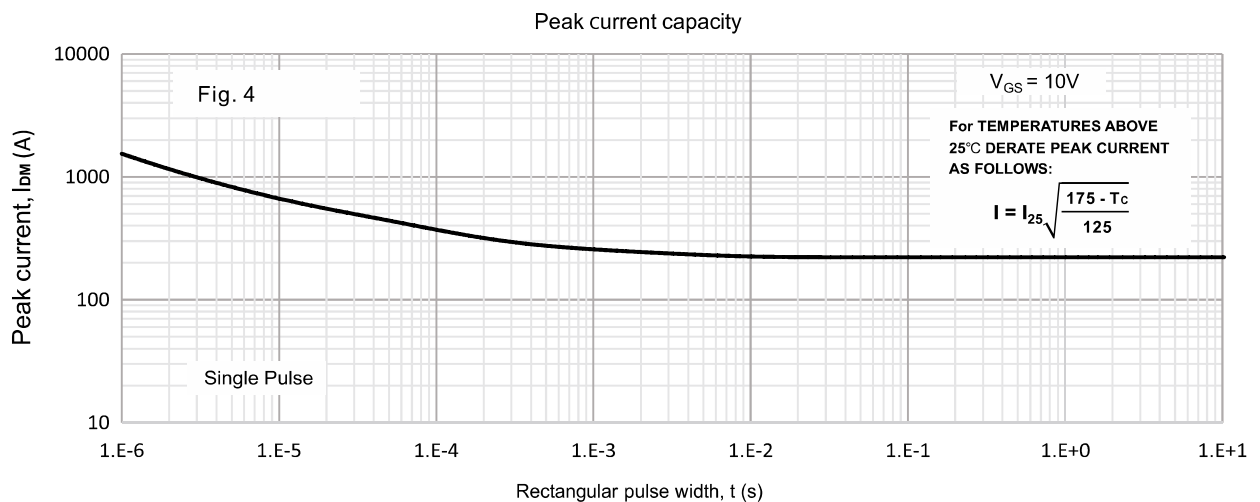
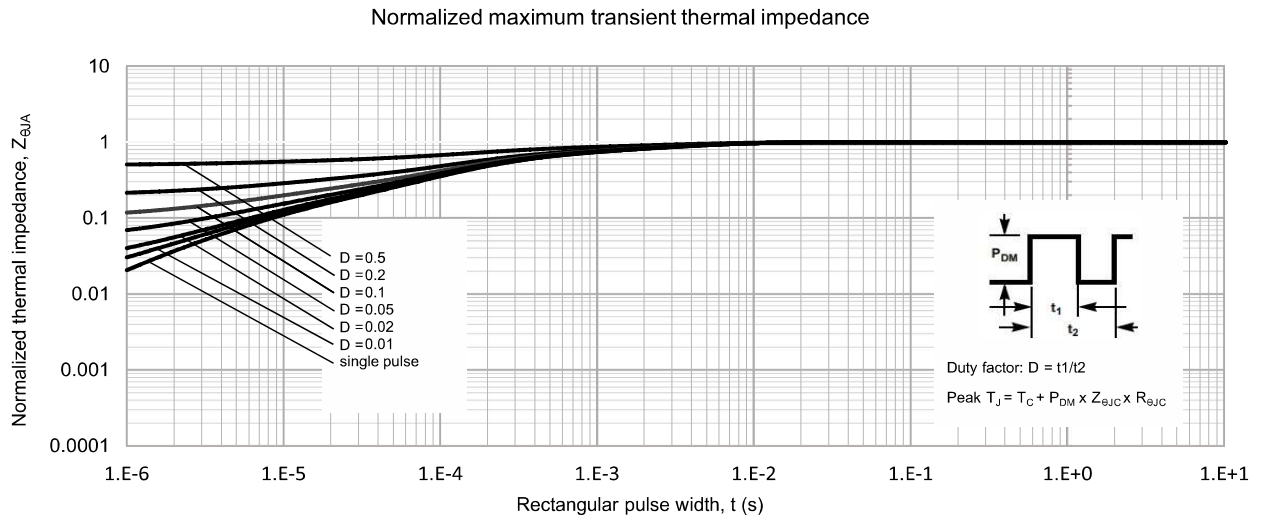
FMOSAC176N04-Q1-H

Rating and characteristic curves



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Rating and characteristic curves



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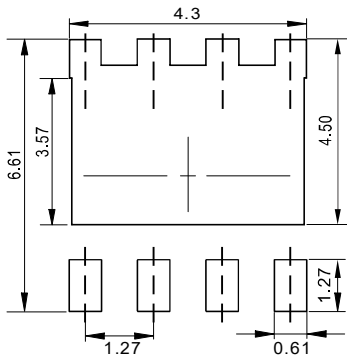
Pinning information

Pin	Simplified outline	Symbol
Pin 1, 2, 3 Source Pin 4 Gate Pin 5, 6, 7, 8 Drain		

Marking

Type numbe	Marking code
FMOSAC176N04-Q1	SL0402MQ

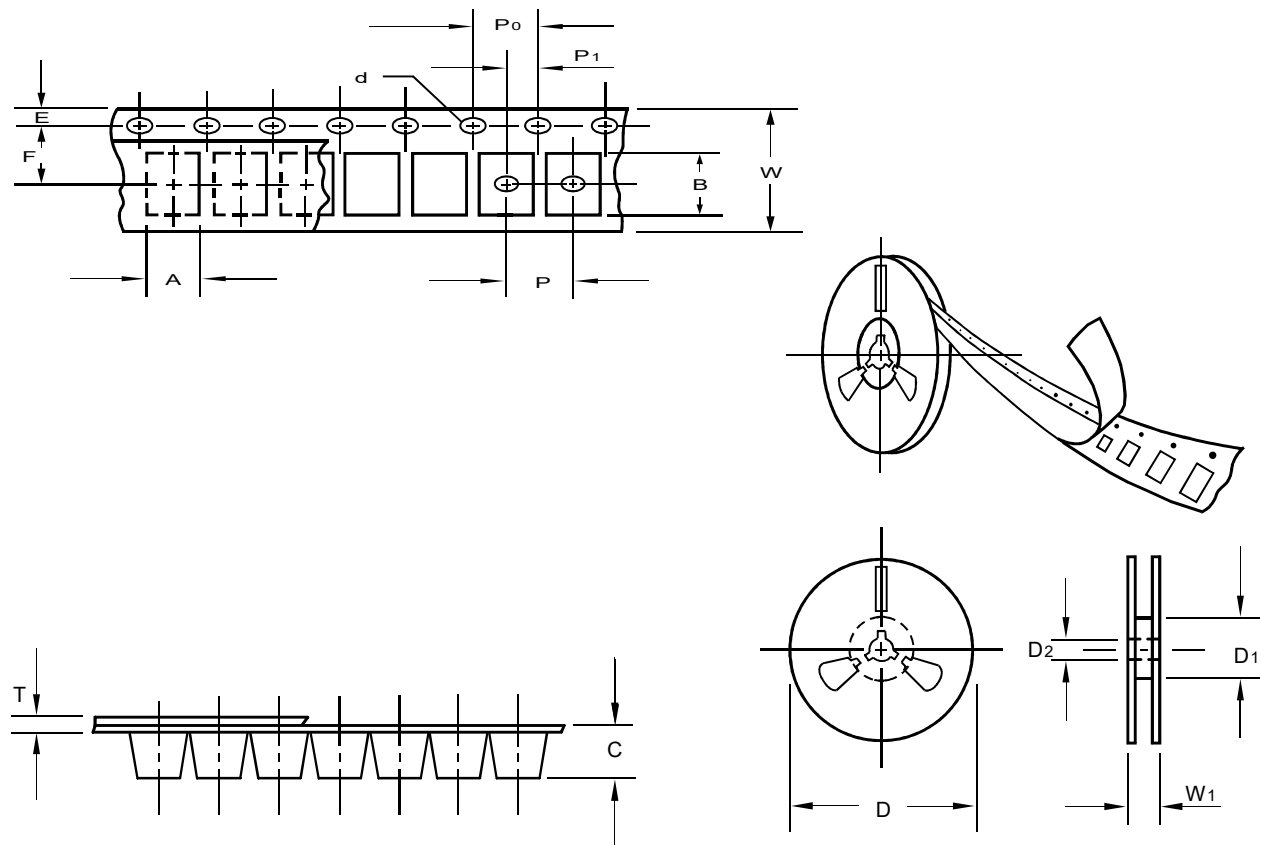
Suggested solder pad layout



Note:
1. Controlling dimension: in millimeters.
2. General tolerance: $\pm 0.05\text{mm}$
3. The pad layout is for reference purposes only.

FMOSAC176N04-Q1-H

Packing information



unit:mm

Item	Symbol	Tolerance	T5060P8
Carrier width	A	0.1	6.40
Carrier length	B	0.1	5.40
Carrier depth	C	0.1	1.25
Sprocket hole	d	0.1	1.55
13" Reel outside diameter	D	2.0	330.00
13" Reel inner diameter	D ₁	min	100.00
7" Reel outside diameter	D	2.0	-
7" Reel inner diameter	D ₁	min	-
Feed hole diameter	D ₂	0.5	13.00
Sprocket hole position	E	0.1	1.75
Punch hole position	F	0.1	5.50
Punch hole pitch	P	0.1	8.00
Sprocket hole pitch	P ₀	0.1	4.00
Embossment center	P ₁	0.1	2.00
Overall tape thickness	T	0.1	0.30
Tape width	W	0.3	12.00
Reel width	W ₁	1.0	17.60

Note: Devices are packed in accordance with EIA standard RS-481-A and specifications listed above.

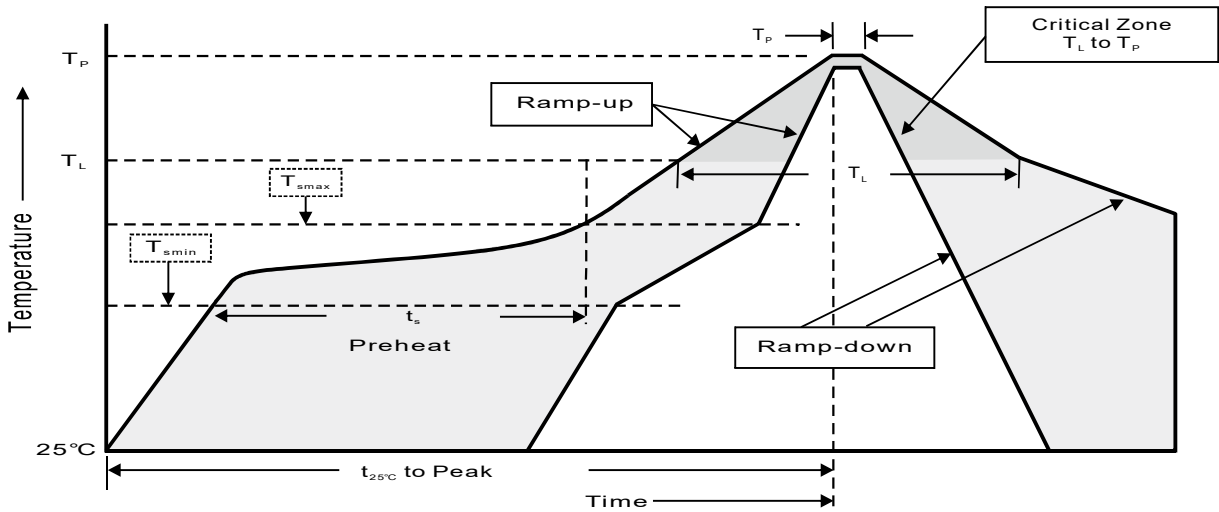
FMOSAC176N04-Q1-H

Reel packing

Device	Outline	Device Package	Reel Size	Reel (pcs)
FMOSAC176N04-Q1	Taping	T5060P8	13 inch	5,000

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

FMOSAC176N04-Q1-H

High reliability test capabilities

Item Test	Conditions	Reference
1. MSL Preconditioning	24hr bake@125°C+168hrs@85°C /85%RH+3xIR@260°C+1flux immersion+alcohol+DI H2O rinse	JESD22-A113
2. High Temperature Reverse Bias	$V_{DS}=V_{DS}^*80\%$ ($T_J=T_J \text{ max.}$) Test Duration:1000hrs	JESD22-A108
3. High Temperature Storage Life	$T_a=150^\circ\text{C}$ Test Duration:1000hrs	JESD22 A-103
4. Temperature Cycle	-55°C (15min) to 150°C (15min) Test Cycles:1000cycles	JESD22 A-104
5. Autoclave	$P=2\text{atm}$ $T_a=121^\circ\text{C}$ RH=100% Test Duration:96hrs	JESD22 A-102
6. Solderability	$245\pm5^\circ\text{C}$ for 5sec	J-STD-002
7. Moisture Resistance	$T_a=85^\circ\text{C}$ /85% Relative humidity Test Duration:1000hrs	MIL-STD-750E METHOD 1021.2
8. Resistance To Solder Heat	$260\pm5^\circ\text{C}$ for 10sec	JESD22 B-106
9. High Temperature High Humidity Reverse Bias	$T_a=85^\circ\text{C}$, 85%RH, $V_{DS}=80\%$ rated V_{DS} Test Duration: 1000hrs	JESD22-A101