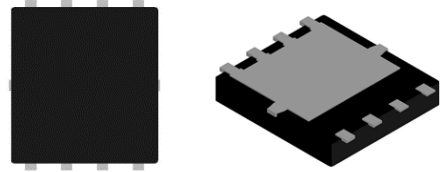


FEATURES

- Drain-Source Withstand Voltage: -40V
- Max. $R_{DS(on)}$: $13m\Omega @ V_{GS}=-10V$
 $18m\Omega @ V_{GS}=-4.5V$
- Automotive applications
- AEC-Q101 Qualified
- Excellent ON resistance
- General footprint package PDFN5×6-8L
- 100% Rg and Avalanche tested
- MSL1

PRODUCT APPEARANCE


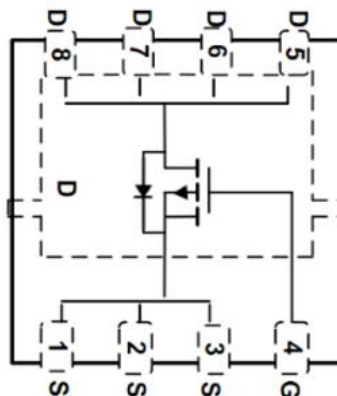
PDFN5×6-8L

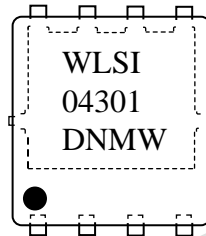
DESCRIPTION

The SPM0413DNAQ is P-Channel enhancement MOS Field Effect Transistor. Uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in high performance automotive DC-DC conversion, power switch and charging circuit. Standard Product SPM0413DNAQ is Pb-free.

Applications:

- Automotive systems
- DC/DC converters
- Power supply converters circuit
- Load/Power Switching for portable device

PIN CONFIGURATION


MARKING


WLSI = Company (Group) Code
 04301 = Device Code
 DN = Special Code
 M = Month
 W = Week

LIMITING VALUES

Parameter	Symbol	Condition	Value	Unit
Drain-Source Voltage	V_{DS}		-40	V
Gate-Source Voltage	V_{GS}		± 20	V
Continuous Drain Current	I_D	$T_C=25^\circ\text{C}$	-56	A
		$T_C=100^\circ\text{C}$	-40	A
Pulsed Drain Current	I_{DM}		-144	A
Continuous Drain Current	I_D	$T_A=25^\circ\text{C}$	-11.3	A
		$T_A=100^\circ\text{C}$	-8.0	A
Avalanche Energy $L=0.3\text{mH}$	E_{AS}		111	mJ
Power Dissipation ⁽²⁾	P_D	$T_C=25^\circ\text{C}$	81	W
		$T_C=100^\circ\text{C}$	41	W
Power Dissipation ⁽¹⁾	P_D	$T_A=25^\circ\text{C}$	3.2	W
		$T_A=100^\circ\text{C}$	1.6	W
Operating Junction Temperature	T_J		-55 to 175	$^\circ\text{C}$
Storage Temperature Range	T_{STG}		-55 to 175	$^\circ\text{C}$

THERMAL RESISTANCE RATINGS

Single Operation					
Parameter		Symbol	Typical	Maximum	Unit
Junction-to-Ambient Thermal Resistance ⁽¹⁾	Steady State	$R_{\theta JA}$	39	46	°C/W
Junction-to-Case Thermal Resistance ⁽²⁾	Steady State	$R_{\theta JC}$	1.3	1.8	

ELECTRONICS CHARACTERISTICS

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
OFF CHARACTERISTICS						
Drain-to-Source Breakdown Voltage	BV_{DSS}	$V_{GS}=0\text{ V}$, $I_D = -250\mu\text{A}$	-40			V
Drain-to-Source Breakdown Voltage Temperature Coefficient	BV_{DSS}/T_J			-30		mV/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS}=-40\text{V}$, $V_{GS}=0\text{V}$, $T_J=25^\circ\text{C}$			-1	μA
		$V_{DS}=-40\text{V}$, $V_{GS}=0\text{V}$, $T_J=125^\circ\text{C}$			-10	μA
Gate-to-source Leakage Current	I_{GSS}	$V_{DS}=0\text{ V}$, $V_{GS}= \pm 20\text{V}$			± 100	nA
ON CHARACTERISTICS						
Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS}=V_{DS}$, $I_D = -250\mu\text{A}$	-1.3	-1.7	-2.1	V
Threshold Temperature Coefficient	$V_{GS(TH)}/T_J$			5		mV/°C
Drain-to-source On-resistance ⁽⁴⁾	$R_{DS(on)}$	$V_{GS} = -10\text{V}$, $I_D = -10\text{A}$		9.5	13	m Ω
		$V_{GS} = -4.5\text{V}$, $I_D = -10\text{A}$		12.0	18	
CHARGES, CAPACITANCES AND GATE RESISTANCE						
Input Capacitance	C_{ISS}	$V_{GS} = 0\text{V}$, $f = 1.0\text{MHz}$, $V_{DS} = -25\text{V}$		2810		pF
Output Capacitance	C_{OSS}			240		
Reverse Transfer Capacitance	C_{RSS}			170		
Total Gate Charge ⁽⁵⁾	$Q_{G(TOT)}$	$V_{GS} = -10\text{V}$, $V_{DS} = -32\text{V}$, $I_D = -10\text{A}$		51		nC

Parameter	Symbol	Conditions	Min	Typ	Max	Unit
Gate-to-Source Charge ⁽⁵⁾	Q_{GS}	$V_{GS}=-10V,$ $V_{DS}= -32V,$ $I_D =-10A$		7.2		
Gate-to-Drain Charge ⁽⁵⁾	Q_{GD}			10.8		
Gate Resistance	R_g	$f = 1MHz$		12		Ω
SWITCHING CHARACTERISTICS ⁽⁵⁾						
Turn-On Delay Time	$t_d(ON)$	$V_{GS}=-10V,$ $V_{DS}= -32V,$ $I_D=-10A, R_G=5\Omega$		6.2		ns
Rise Time	t_r			26.7		
Turn-Off Delay Time	$t_d(OFF)$			108.5		
Fall Time	t_f			53.5		
Body Diode Reverse Recovery Time	t_{rr}	$I_F=-10A,$ $dI/dt= 100A/\mu s$		19		ns
Body Diode Reverse Recovery Charge	Q_{rr}	$I_F=-10A,$ $dI/dt= 100A/\mu s$		6		nC
BODY DIODE CHARACTERISTICS						
Forward Voltage ⁽⁴⁾	V_{SD}	$V_{GS}=0V, I_S=-10A$	-0.5	-0.8	-1.2	V

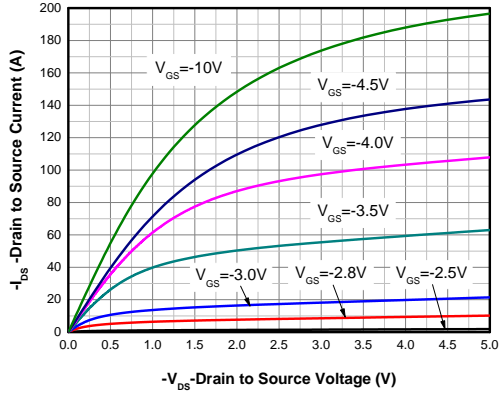
($T_J=25^\circ C$, unless otherwise noted.)

Note:

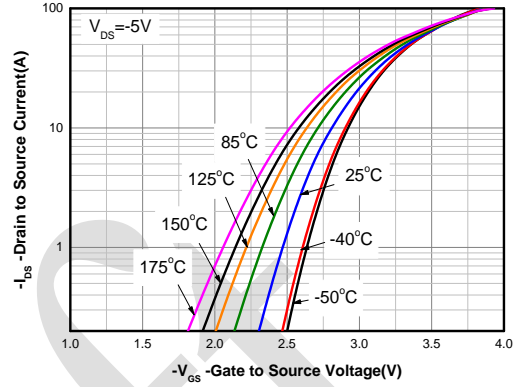
- (1) FR-4 board (38mm × 38mm × t1.6mm, 70μm Copper) partially covered with copper (645mm² area). The power dissipation P_{DSM} is based on Junction-to-Ambient thermal resistance value and the $T_{J(MAX)}=175^\circ C$. The value is only for reference, any application depends on the user's specific board design.
- (2) The power dissipation P_D is based on $T_{J(MAX)}=175^\circ C$, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heat sinking is used.
- (3) Repetitive rating, pulsed, duty cycle ~1%, keep initial $T_J=25^\circ C$, the maximum allowed junction temperature of 175°C.
- (4) The static characteristics are obtained using ~380μs pulses, duty cycle ~1%.
- (5) The parameter is not subject to production test – verified by design / characterization.

TYPICAL CHARACTERISTICS

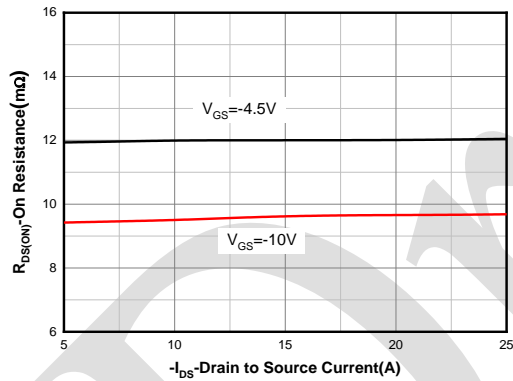
Ta=25°C, unless otherwise noted.



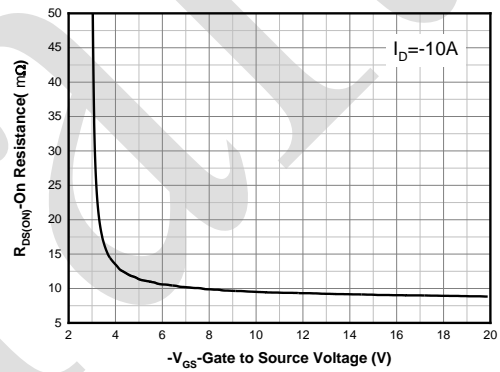
Output Characteristics ⁽⁴⁾



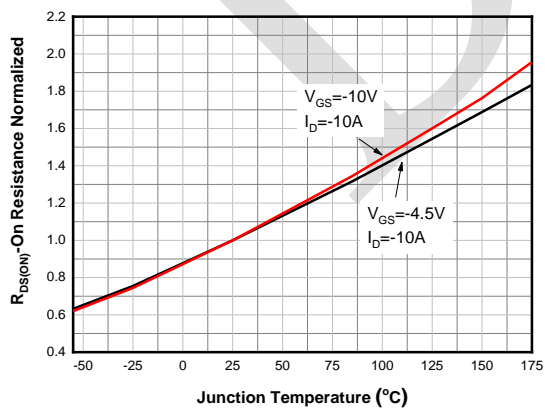
Transfer Characteristics ⁽⁴⁾



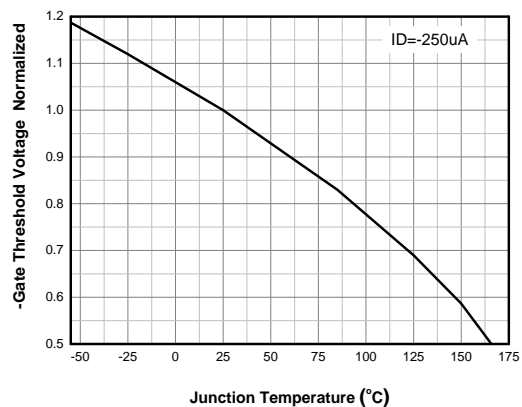
On-Resistance vs. Drain Current ⁽⁴⁾



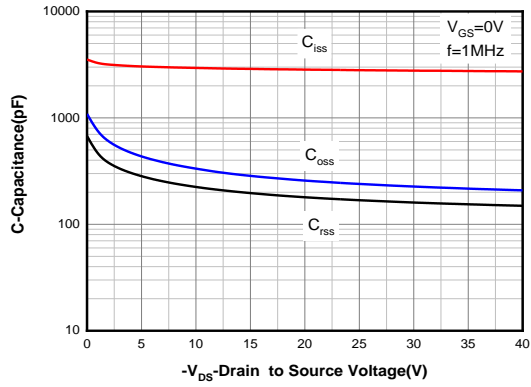
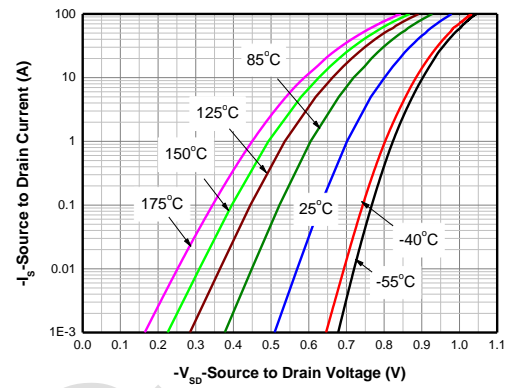
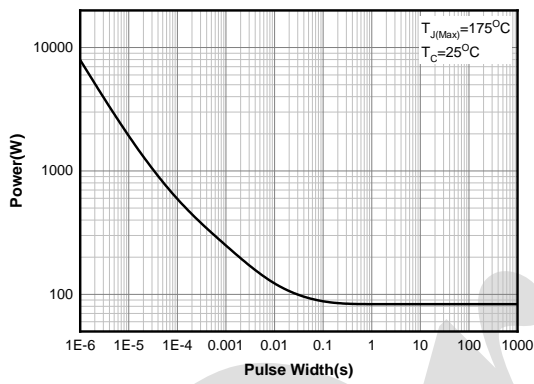
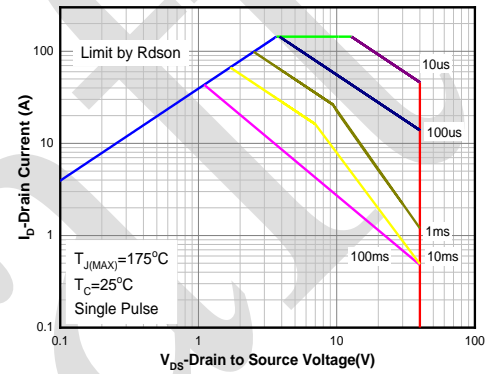
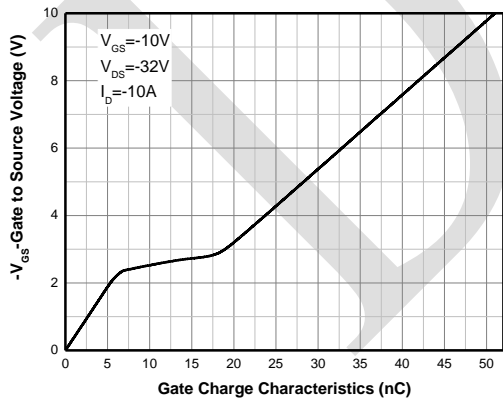
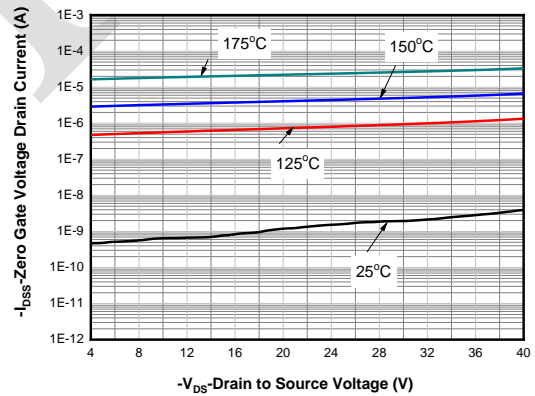
On-Resistance vs. Gate-to-Source Voltage ⁽⁴⁾

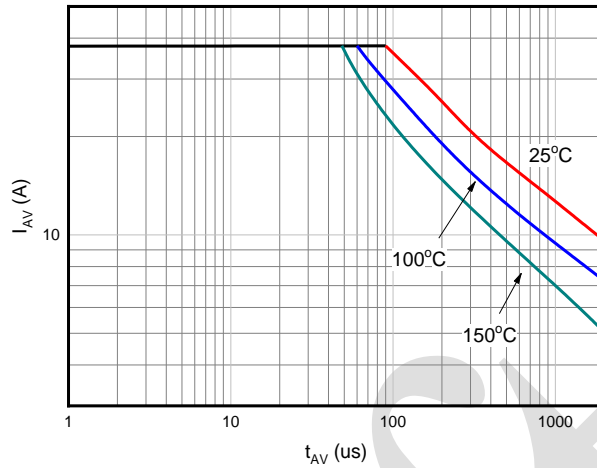
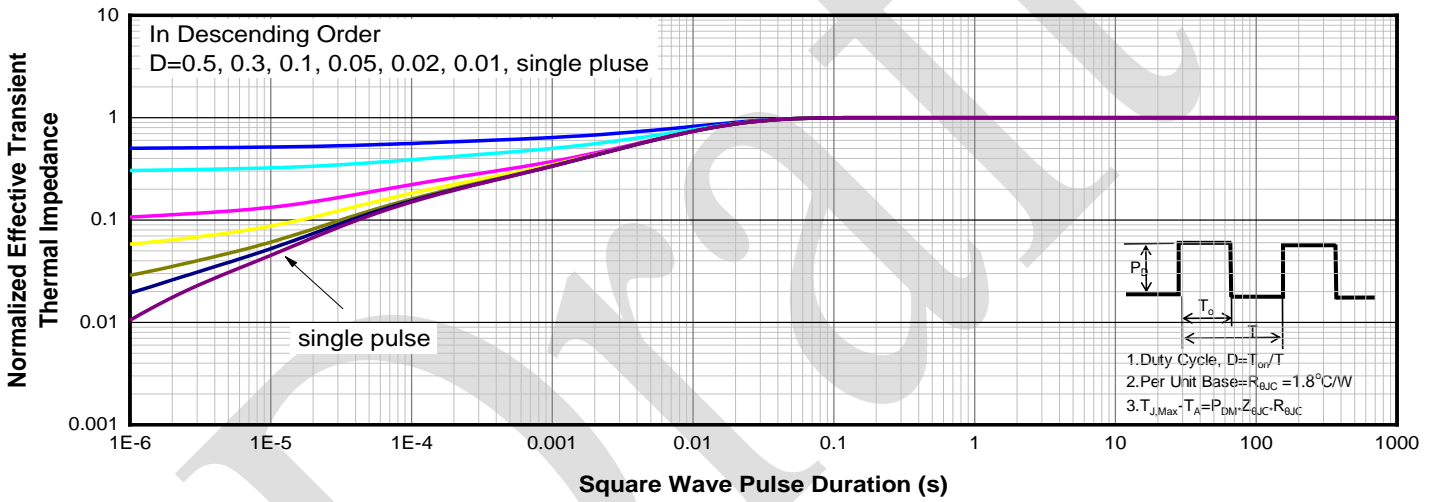
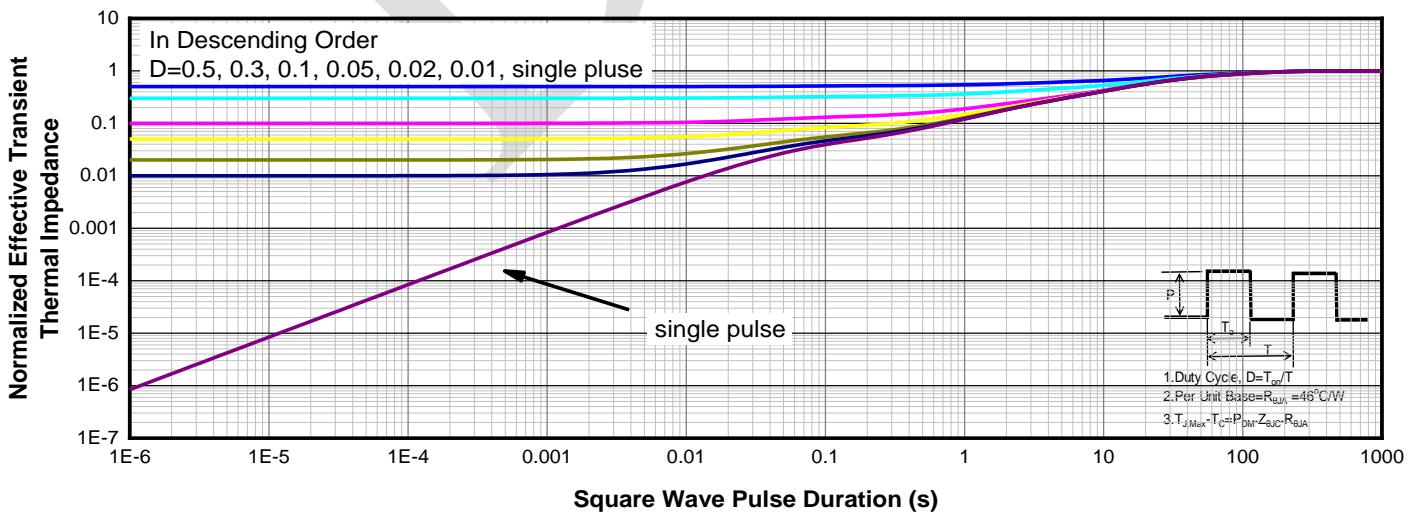


On-Resistance vs. Junction Temperature ⁽⁴⁾



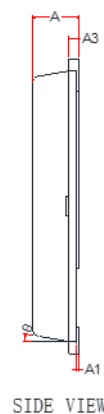
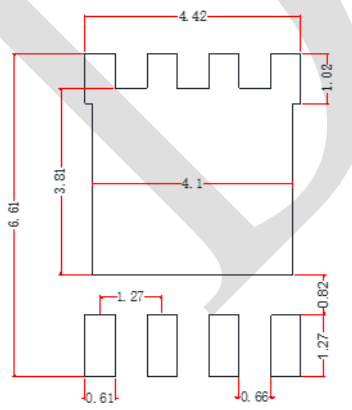
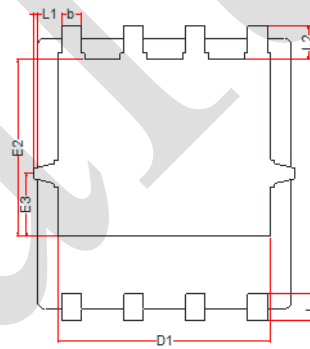
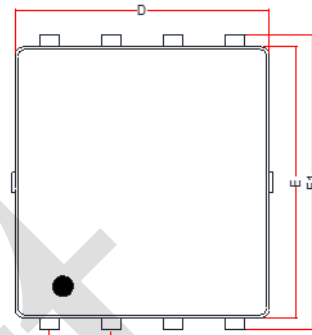
Threshold Voltage vs. Temperature

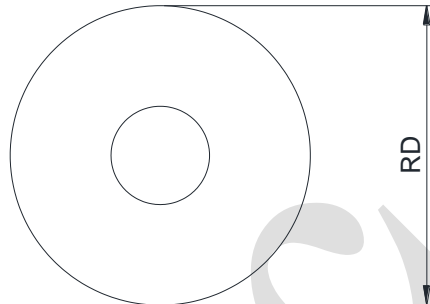
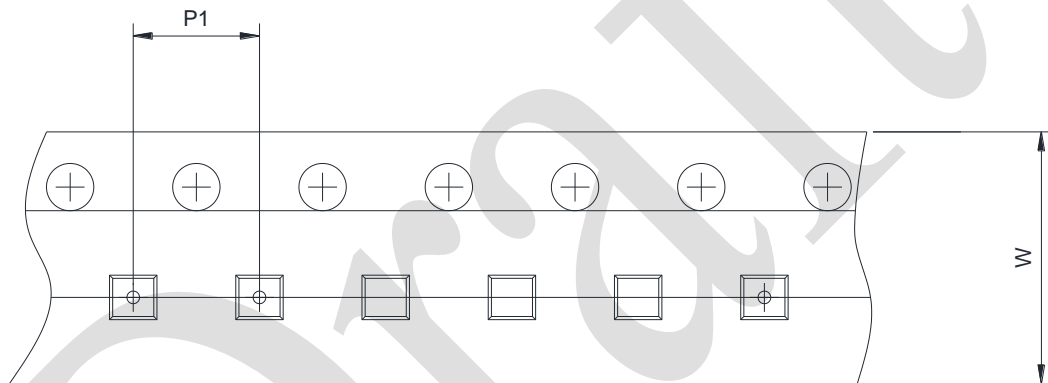
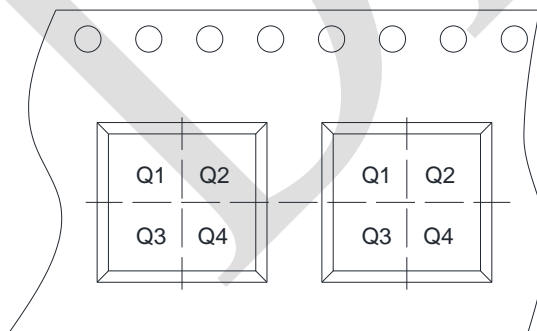

Capacitance

Body Diode Forward Voltage (4)

Single Pulse power

Safe Operating Area

Gate Charge Characteristics

Drain Current vs. Drain Voltage



Avalanche characteristics

Transient Thermal Response (Junction-to-Case)

Transient Thermal Response (Junction-to-Ambient)

PDFN5×6-8L DIMENSIONS
PACKAGE SIZE

Symbol	Min.	Typ.	Max.
A	0.85	0.95	1.00
A1	0.00	-	0.05
A3	-	0.2 Ref	-
b	0.30	0.40	0.50
D	5.10	5.20	5.30
E	5.45	5.55	5.65
e	1.27 BSC		
D1	4.25	4.35	4.45
E1	5.95	6.05	6.15
E2	3.525	3.625	3.725
E3	1.175	1.275	1.375
L	0.45	0.55	0.65
L1	0	-	0.15
L2	0.68 Ref		
θ	0 °	-	10 °



TAPE AND REEL INFORMATION
Reel Dimensions

Tape Dimensions

Quadrant Assignments For PIN1 Orientation In Tape



User Direction of Feed

RD	Reel Dimension	<input type="checkbox"/> 7inch	<input checked="" type="checkbox"/> 13inch
W	Overall width of the carrier tape	<input type="checkbox"/> 8mm	<input checked="" type="checkbox"/> 12mm <input type="checkbox"/> 16mm
P1	Pitch between successive cavity centers	<input type="checkbox"/> 2mm	<input type="checkbox"/> 4mm <input checked="" type="checkbox"/> 8mm
Pin1	Pin1 Quadrant	<input checked="" type="checkbox"/> Q1	<input type="checkbox"/> Q2 <input type="checkbox"/> Q3 <input type="checkbox"/> Q4

ORDERING INFORMATION

TYPE NUMBER	PACKAGE	PACKING
SPM0413DNAQ-8/TR	PDFN5×6-8L	Tape and reel

PDFN5×6-8L is packed with 5000 pieces/disc in braided packaging.

Important statement

SIT reserves the right to change the above-mentioned information without prior notice.

REVISION HISTORY

Version number	Datasheet status	Revision date
V0.2	Draft version.	May 2024

Draft