



SamHop Microelectronics Corp.



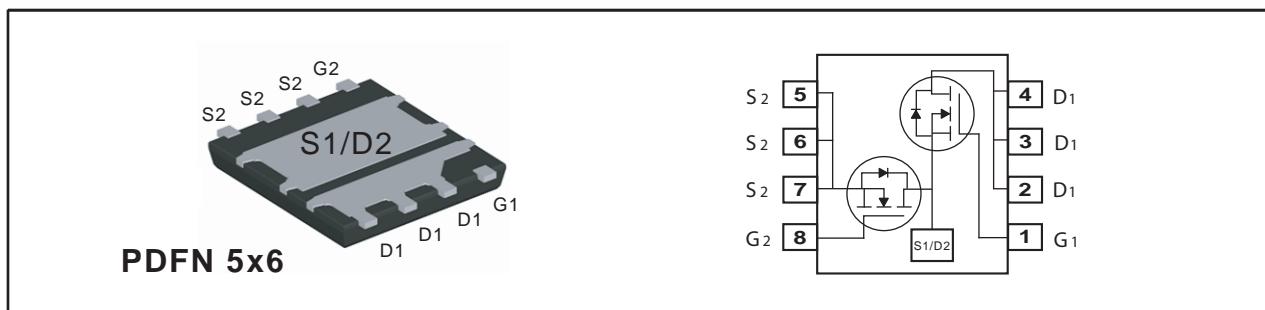
SP4400

Ver 1.0

## Dual N-Channel Enhancement Mode Field Effect Transistor

PRODUCT SUMMARY (DIE 1)		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DSON</sub> (mΩ) Max
40V	28A	23 @ V <sub>GS</sub> =10V
		34 @ V <sub>GS</sub> =4.5V

PRODUCT SUMMARY (DIE 2)		
V <sub>DSS</sub>	I <sub>D</sub>	R <sub>DSON</sub> (mΩ) Max
40V	66A	10 @ V <sub>GS</sub> =10V
		15 @ V <sub>GS</sub> =4.5V



### ABSOLUTE MAXIMUM RATINGS (T<sub>C</sub>=25°C unless otherwise noted)

Symbol	Parameter	Die 1	Die 2	Units
V <sub>DS</sub>	Drain-Source Voltage	40		V
V <sub>GS</sub>	Gate-Source Voltage		±20	V
I <sub>D</sub>	Drain Current-Continuous <sup>c</sup>	T <sub>C</sub> =25°C	28	A
		T <sub>C</sub> =70°C	22.4	A
I <sub>DM</sub>	-Pulsed <sup>a,c</sup>	62	114	A
E <sub>AS</sub>	Sigle Pulse Avalanche Energy <sup>d</sup>	49	121	mJ
P <sub>D</sub>	Maximum Power Dissipation	T <sub>C</sub> =25°C	31	W
		T <sub>C</sub> =70°C	20	W
T <sub>J</sub> , T <sub>STG</sub>	Operating Junction and Storage Temperature Range	-55 to 150		°C

### THERMAL CHARACTERISTICS

R <sub>θJC</sub>	Thermal Resistance, Junction-to-Case	4	1.6	°C/W
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Details are subject to change without notice.

Mar,19,2015

# SP4400

Ver 1.0

## DIE 1 - ELECTRICAL CHARACTERISTICS ( $T_c=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0V, I_D=250\mu\text{A}$	40			V
Idss	Zero Gate Voltage Drain Current	$V_{DS}=32V, V_{GS}=0V$			1	$\mu\text{A}$
IGSS	Gate-Body Leakage Current	$V_{GS} = \pm 20V, V_{DS}=0V$			$\pm 100$	nA
<b>ON CHARACTERISTICS</b>						
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}, I_D=250\mu\text{A}$	1	1.8	3	V
R <sub>DSON</sub>	Drain-Source On-State Resistance	$V_{GS}=10V, I_D=7A$		18	23	m ohm
		$V_{GS}=4.5V, I_D=6A$		25	34	m ohm
g <sub>FS</sub>	Forward Transconductance	$V_{DS}=5V, I_D=7A$		15		S
<b>DYNAMIC CHARACTERISTICS</b> <sup>b</sup>						
C <sub>ISS</sub>	Input Capacitance	$V_{DS}=20V, V_{GS}=0V$ $f=1.0\text{MHz}$		533		pF
C <sub>OSS</sub>	Output Capacitance			87		pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			71		pF
<b>SWITCHING CHARACTERISTICS</b> <sup>b</sup>						
t <sub>D(ON)</sub>	Turn-On Delay Time	$V_{DD}=20V$ $I_D=1A$ $V_{GS}=10V$ $R_{GEN}=6\text{ ohm}$		12		ns
t <sub>r</sub>	Rise Time			13		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			18		ns
t <sub>f</sub>	Fall Time			21		ns
Q <sub>g</sub>	Total Gate Charge	$V_{DS}=20V, I_D=7A, V_{GS}=10V$		10		nC
		$V_{DS}=20V, I_D=7A, V_{GS}=4.5V$		5.5		nC
Q <sub>gs</sub>	Gate-Source Charge	$V_{DS}=20V, I_D=7A,$ $V_{GS}=10V$		1.2		nC
Q <sub>gd</sub>	Gate-Drain Charge			3		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
V <sub>SD</sub>	Diode Forward Voltage	$V_{GS}=0V, I_s=1A$		0.77	1.2	V
<b>Notes</b>						
a.Pulse Test:Pulse Width < 10us, Duty Cycle < 1%.						
b.Guaranteed by design, not subject to production testing.						
c.Drain current limited by maximum junction temperature.						
d.Starting $T_J=25^\circ\text{C}$ , $L=0.5\text{mH}$ , $V_{DD}=20V$ . (See Figure13)						
e.Mounted on FR4 Board of 1 inch <sup>2</sup> , 2oz.						

Mar,19,2015

# SP4400

Ver 1.0

## DIE 2 - ELECTRICAL CHARACTERISTICS ( $T_c=25^\circ\text{C}$ unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
<b>OFF CHARACTERISTICS</b>						
BVDSS	Drain-Source Breakdown Voltage	$V_{GS}=0\text{V}$ , $I_D=250\mu\text{A}$	40			V
Idss	Zero Gate Voltage Drain Current	$V_{DS}=32\text{V}$ , $V_{GS}=0\text{V}$			1	$\mu\text{A}$
IGSS	Gate-Body Leakage Current	$V_{GS}= \pm 20\text{V}$ , $V_{DS}=0\text{V}$			$\pm 100$	nA
<b>ON CHARACTERISTICS</b>						
$V_{GS(\text{th})}$	Gate Threshold Voltage	$V_{DS}=V_{GS}$ , $I_D=250\mu\text{A}$	1	1.6	3	V
R <sub>D<sub>S(ON)</sub></sub>	Drain-Source On-State Resistance	$V_{GS}=10\text{V}$ , $I_D=16.5\text{A}$		8	10	m ohm
		$V_{GS}=4.5\text{V}$ , $I_D=13.5\text{A}$		11	15	m ohm
g <sub>FS</sub>	Forward Transconductance	$V_{DS}=5\text{V}$ , $I_D=16.5\text{A}$		22		S
<b>DYNAMIC CHARACTERISTICS <sup>b</sup></b>						
C <sub>ISS</sub>	Input Capacitance	$V_{DS}=20\text{V}, V_{GS}=0\text{V}$ $f=1.0\text{MHz}$		1414		pF
C <sub>OSS</sub>	Output Capacitance			170		pF
C <sub>RSS</sub>	Reverse Transfer Capacitance			146		pF
<b>SWITCHING CHARACTERISTICS <sup>b</sup></b>						
t <sub>D(ON)</sub>	Turn-On Delay Time	$V_{DD}=20\text{V}$ $I_D=1\text{A}$ $V_{GS}=10\text{V}$ R <sub>GEN</sub> = 6 ohm		23		ns
t <sub>r</sub>	Rise Time			27		ns
t <sub>D(OFF)</sub>	Turn-Off Delay Time			68		ns
t <sub>f</sub>	Fall Time			38		ns
Q <sub>g</sub>	Total Gate Charge	$V_{DS}=20\text{V}, I_D=16.5\text{A}, V_{GS}=10\text{V}$		23		nC
		$V_{DS}=20\text{V}, I_D=16.5\text{A}, V_{GS}=4.5\text{V}$		12		nC
Q <sub>gs</sub>	Gate-Source Charge	$V_{DS}=20\text{V}, I_D=16.5\text{A},$ $V_{GS}=10\text{V}$		2		nC
Q <sub>gd</sub>	Gate-Drain Charge			6.2		nC
<b>DRAIN-SOURCE DIODE CHARACTERISTICS AND MAXIMUM RATINGS</b>						
V <sub>SD</sub>	Diode Forward Voltage	$V_{GS}=0\text{V}, I_S=3\text{A}$		0.78	1.2	V
<b>Notes</b>						
a.Pulse Test:Pulse Width < 10us, Duty Cycle < 1%.						
b.Guaranteed by design, not subject to production testing.						
c.Drain current limited by maximum junction temperature.						
d.Starting $T_J=25^\circ\text{C}$ , $L=0.5\text{mH}$ , $V_{DD} = 20\text{V}$ . (See Figure13)						
e.Mounted on FR4 Board of 1 inch <sup>2</sup> , 2oz.						

Mar,19,2015

Die 1

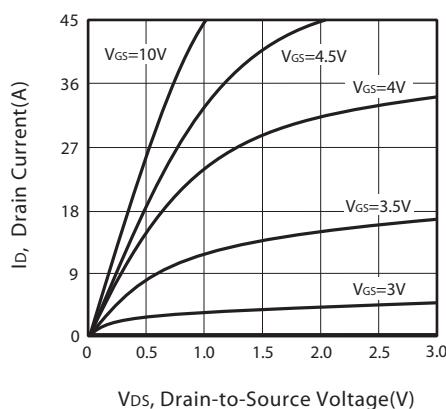


Figure 1. Output Characteristics

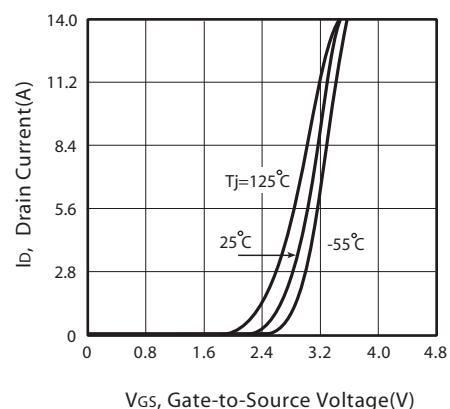


Figure 2. Transfer Characteristics

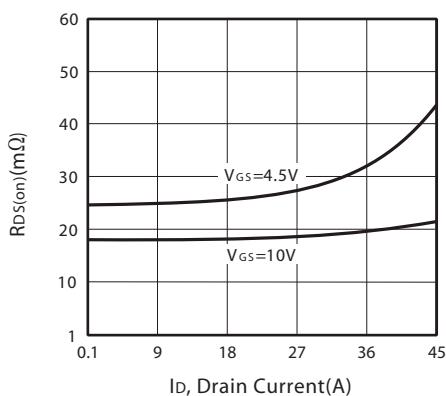


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

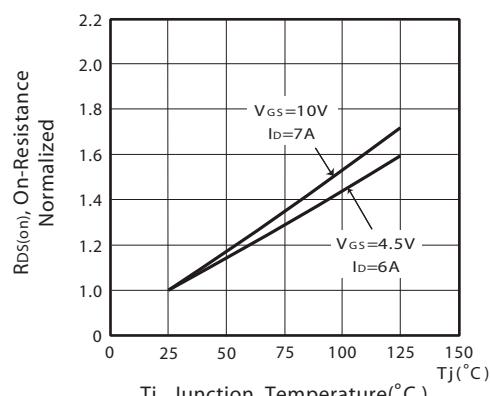


Figure 4. On-Resistance Variation with Drain Current and Temperature

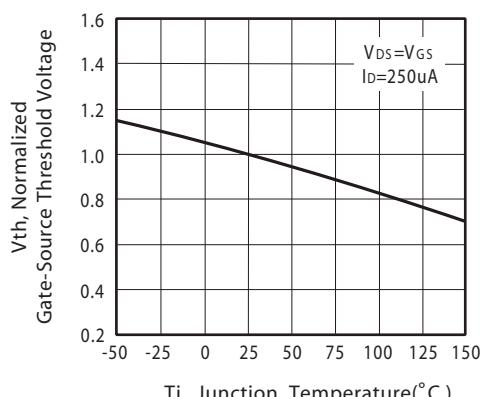


Figure 5. Gate Threshold Variation with Temperature

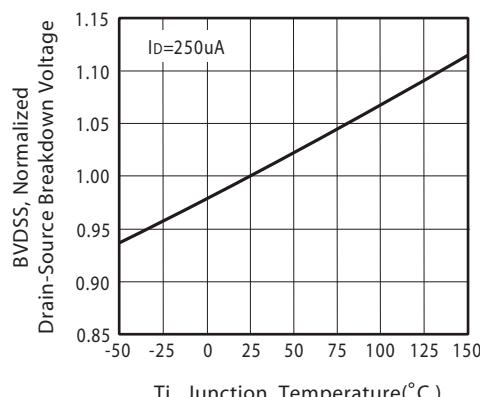


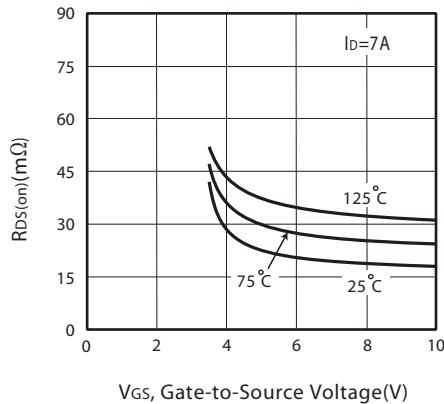
Figure 6. Breakdown Voltage Variation with Temperature

Mar,19,2015

# SP4400

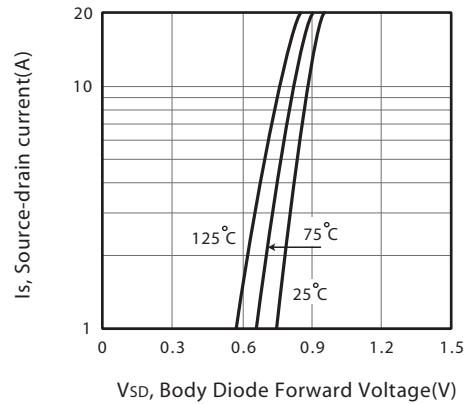
Ver 1.0

Die 1



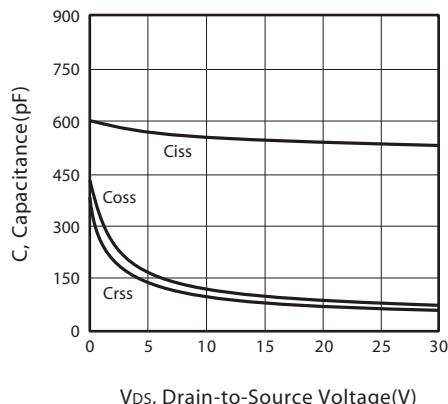
V<sub>GS</sub>, Gate-to-Source Voltage(V)

Figure 7. On-Resistance vs. Gate-Source Voltage



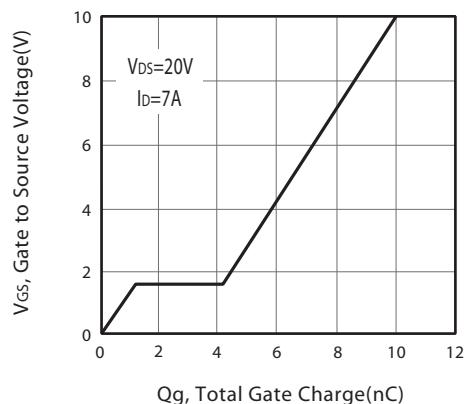
V<sub>SD</sub>, Body Diode Forward Voltage(V)

Figure 8. Body Diode Forward Voltage Variation with Source Current



V<sub>DS</sub>, Drain-to-Source Voltage(V)

Figure 9. Capacitance



Q<sub>g</sub>, Total Gate Charge(nC)

Figure 10. Gate Charge

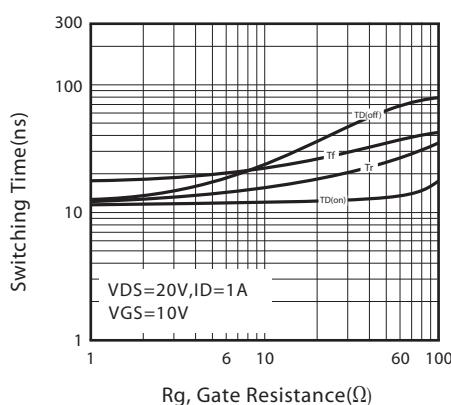


Figure 11. switching characteristics

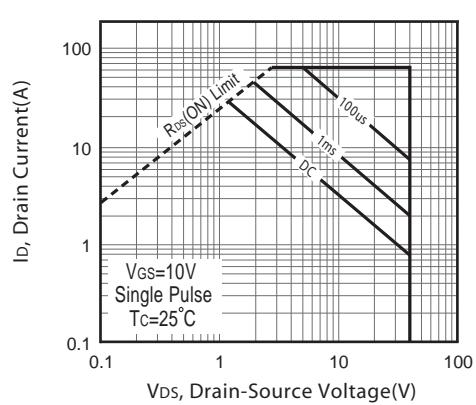


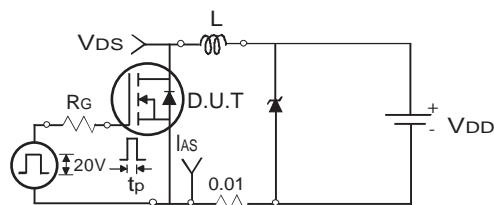
Figure 12. Maximum Safe Operating Area

Mar,19,2015

# SP4400

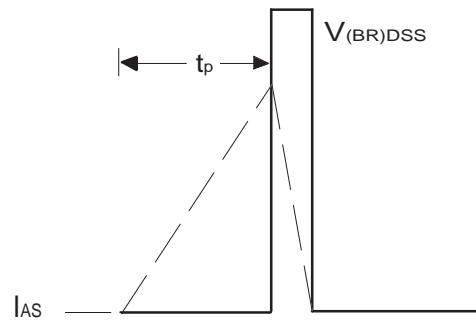
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Die 1



Uncamped Inductive Test Circuit

Figure 13a.



Unclamped Inductive Waveforms

Figure 13b.

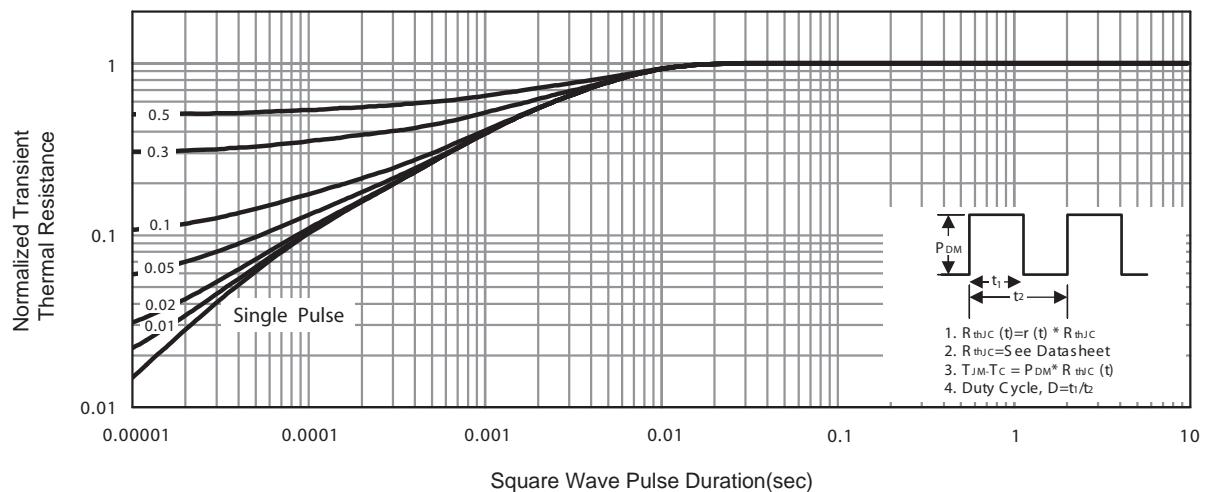


Figure 14. Normalized Thermal Transient Impedance Curve

Mar,19,2015

Die 2

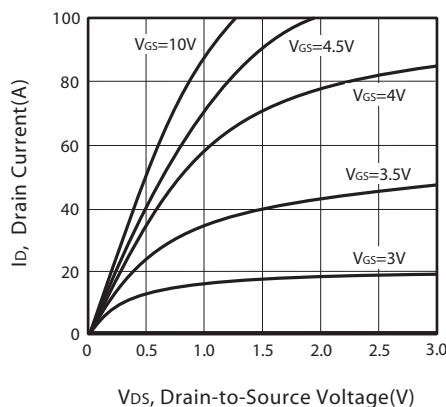


Figure 1. Output Characteristics

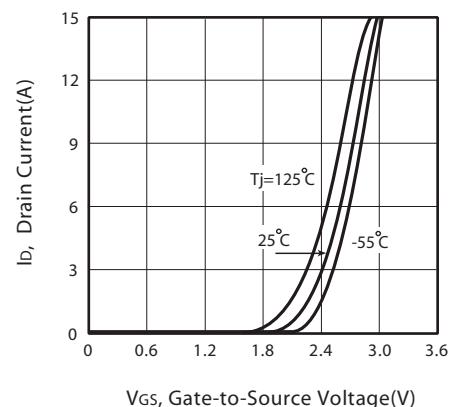


Figure 2. Transfer Characteristics

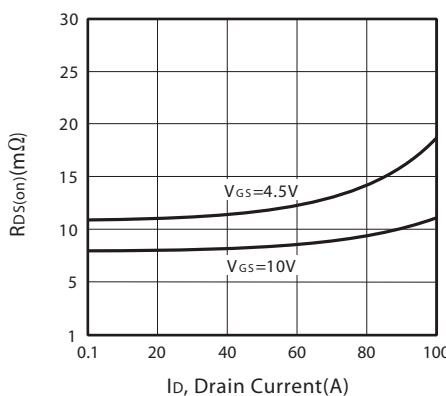


Figure 3. On-Resistance vs. Drain Current and Gate Voltage

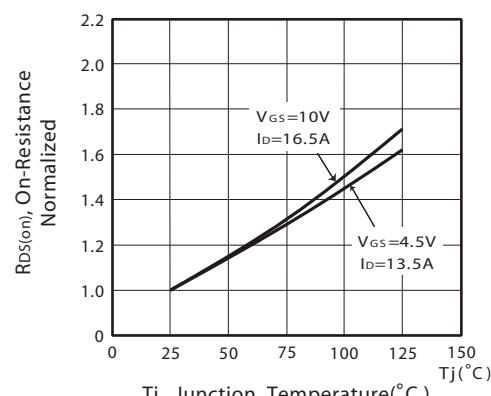


Figure 4. On-Resistance Variation with Drain Current and Temperature

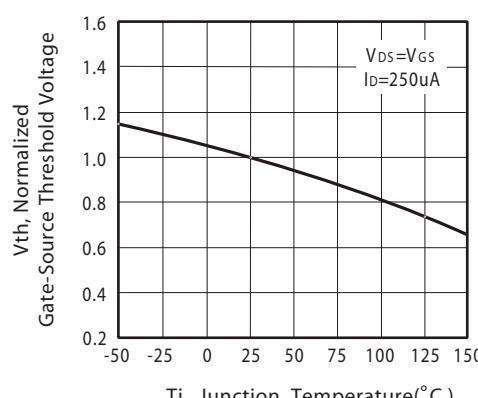


Figure 5. Gate Threshold Variation with Temperature

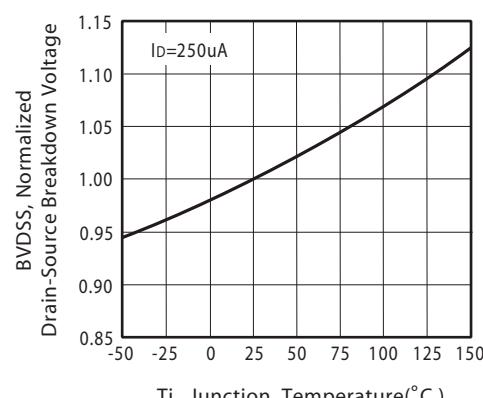


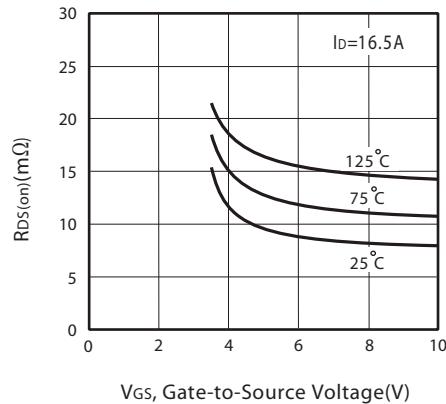
Figure 6. Breakdown Voltage Variation with Temperature

Mar,19,2015

# SP4400

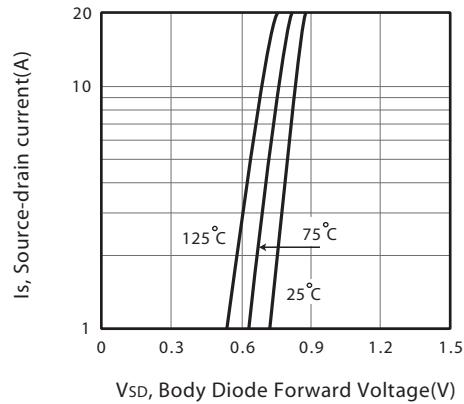
Ver 1.0

Die 2



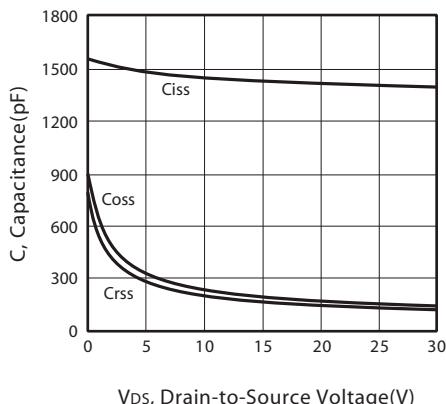
V<sub>GS</sub>, Gate-to-Source Voltage(V)

Figure 7. On-Resistance vs. Gate-Source Voltage



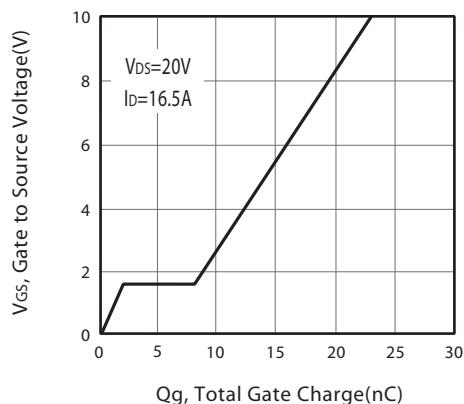
V<sub>SD</sub>, Body Diode Forward Voltage(V)

Figure 8. Body Diode Forward Voltage Variation with Source Current



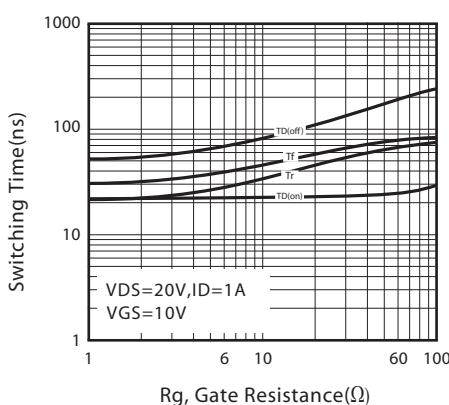
V<sub>DS</sub>, Drain-to-Source Voltage(V)

Figure 9. Capacitance



Q<sub>g</sub>, Total Gate Charge(nC)

Figure 10. Gate Charge



R<sub>g</sub>, Gate Resistance(Ω)

Figure 11. switching characteristics

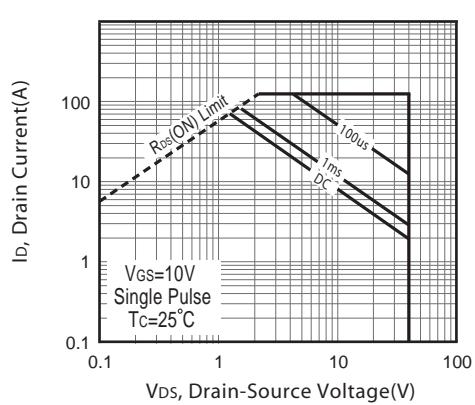


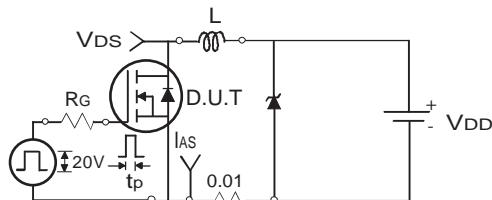
Figure 12. Maximum Safe Operating Area

Mar,19,2015

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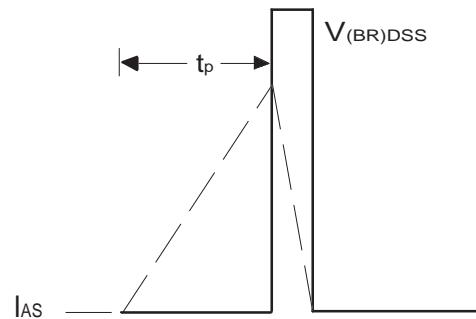
Ver 1.0

Die 2



Uncamped Inductive Test Circuit

Figure 13a.



Unclamped Inductive Waveforms

Figure 13b.

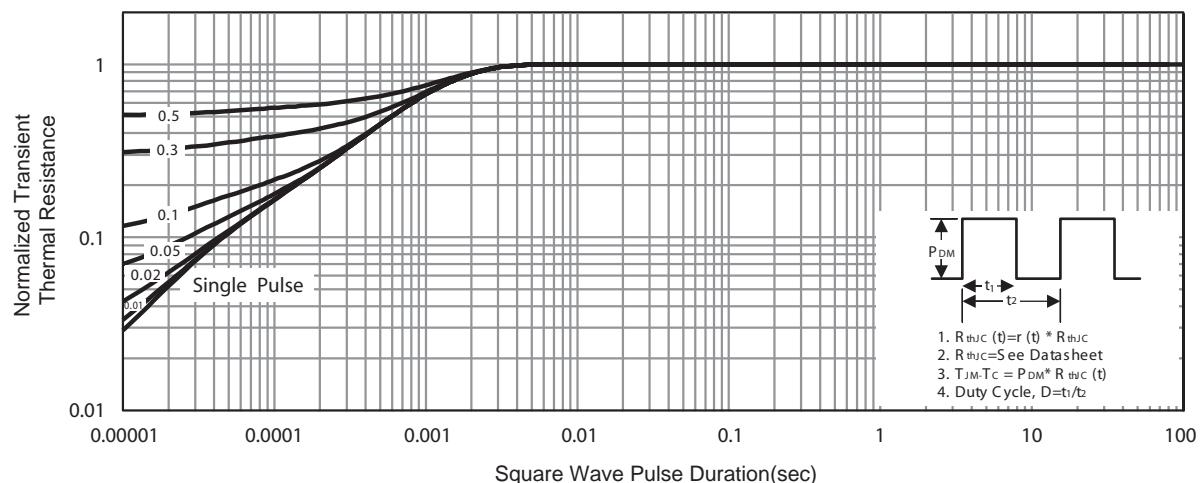
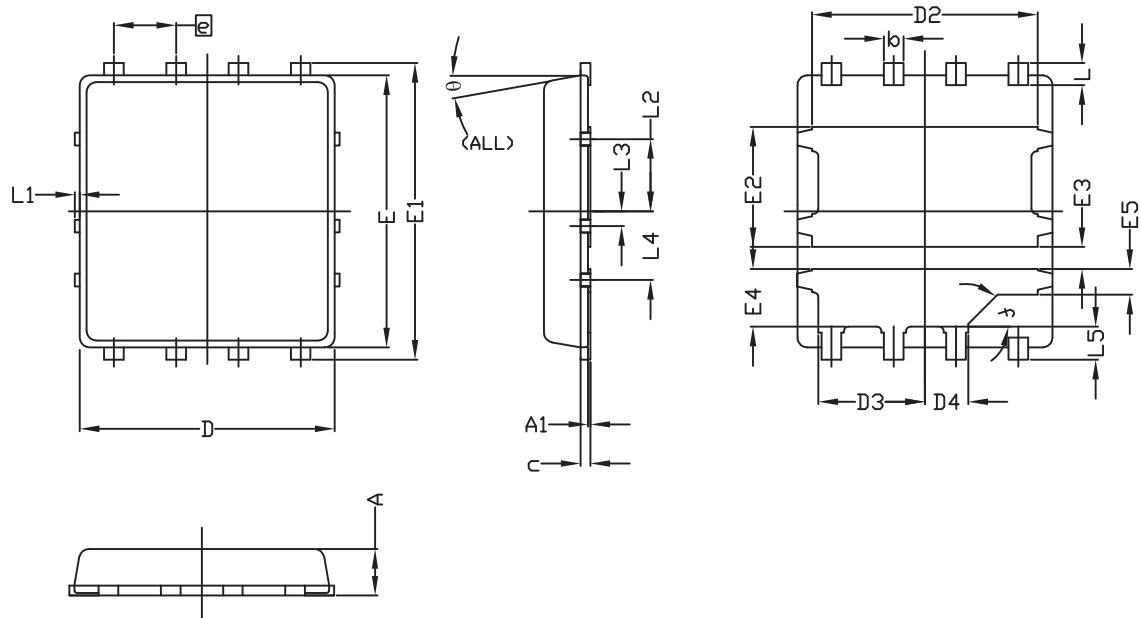


Figure 14. Normalized Thermal Transient Impedance Curve

Mar,19,2015

## PACKAGE OUTLINE DIMENSIONS

### PDFN 5x6-8L



SYMBOLS	MILLIMETERS			INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	0.85	0.90	1.00	0.033	0.035	0.039
A1	0.00	—	0.05	0.000	—	0.002
b	0.35	0.40	0.45	0.014	0.016	0.018
c	0.15	0.20	0.25	0.006	0.008	0.010
D	5.20 BSC			0.205 BSC		
D2	4.50	4.60	4.70	0.177	0.181	0.185
D3	2.125	2.175	2.225	0.084	0.086	0.088
D4	0.835	0.885	0.935	0.033	0.035	0.037
E	5.55 BSC			0.219 BSC		
E1	6.05 BSC			0.238 BSC		
E2	2.40	2.45	2.50	0.094	0.096	0.098
E3	0.40	0.45	0.50	0.016	0.018	0.020
E4	1.125	1.175	1.225	0.044	0.046	0.048
E5	0.475	0.525	0.575	0.019	0.021	0.023
e	1.27 BSC			0.050 BSC		
L	0.35	0.45	0.55	0.014	0.018	0.022
L1	0.00	—	0.10	0.000	—	0.004
L2	1.375	1.475	1.575	0.054	0.058	0.062
L3	0.20	0.30	0.40	0.008	0.012	0.016
L4	1.30	1.40	1.50	0.051	0.055	0.059
L5	0.575	0.675	0.775	0.023	0.027	0.031
f	45°			45°		
θ	0°	—	10°	0°	—	10°

## TOP MARKING DEFINITION

### PDFN 5x6-8L

