

## Dual N-Channel 60 V (D-S) MOSFET

### PRODUCT SUMMARY

$V_{DS}$ (V)	60
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 10$ V	0.028
$R_{DS(on)}$ ( $\Omega$ ) at $V_{GS} = 4.5$ V	0.038
$Q_g$ typ. (nC)	7.1
$I_D$ (A)	25
Configuration	Dual

### FEATURES

- Trench power MOSFET
- PWM optimized
- 100 %  $R_g$  and UIS tested

### APPLICATIONS

- System power DC/DC

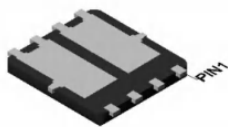


**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**

DFN 3\*3

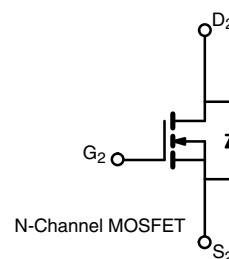
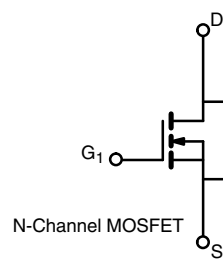
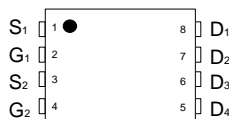


Top View



Bottom View

Top View



### ABSOLUTE MAXIMUM RATINGS ( $T_A = 25$ °C, unless otherwise noted)

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage		$V_{DS}$	60	V
Gate-source voltage		$V_{GS}$	$\pm 20$	
Continuous drain current ( $T_J = 150$ °C)	$T_C = 25$ °C	$I_D$	25	A
	$T_C = 70$ °C		17 <sup>a</sup>	
	$T_A = 25$ °C		12 <sup>a</sup>	
	$T_A = 70$ °C		8 <sup>a</sup>	
Pulsed drain current		$I_{DM}$	75	
Source-drain current diode current	$T_C = 25$ °C	$I_S$	19	
	$T_A = 25$ °C		3 <sup>b, c</sup>	
Maximum power dissipation	$T_C = 25$ °C	$P_D$	22	W
	$T_C = 70$ °C		14	
	$T_A = 25$ °C		3.6 <sup>b, c</sup>	
	$T_A = 70$ °C		2.3 <sup>b, c</sup>	
Operating junction and storage temperature range		$T_J, T_{stg}$	-55 to +150	°C
Soldering recommendations (peak temperature) <sup>d, e</sup>			260	

### THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYP.	MAX.	UNIT
Maximum junction-to-ambient <sup>b, f</sup>	$t \leq 10$ s	$R_{thJA}$	26	35	°C/W
Maximum junction-to-case (drain)	Steady state	$R_{thJC}$	4	5.5	

#### Notes

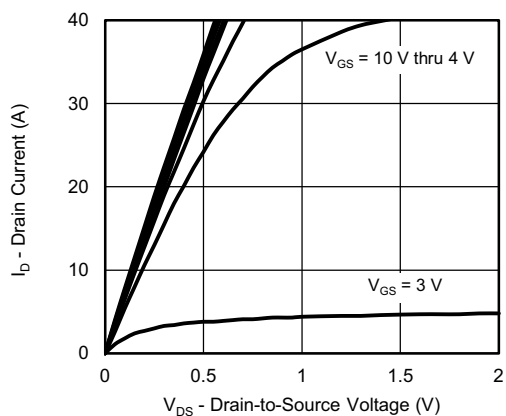
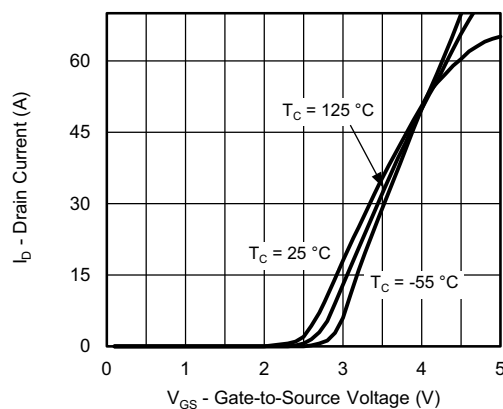
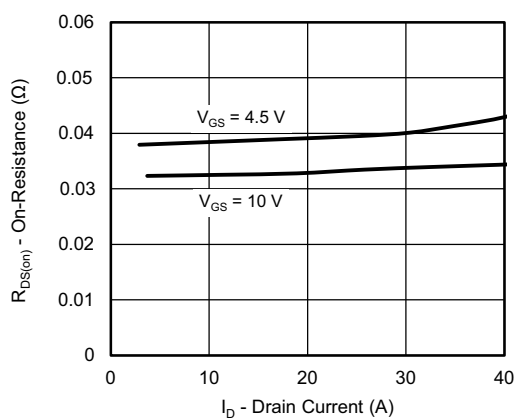
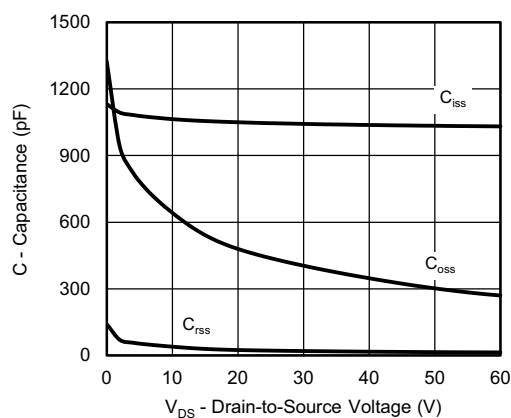
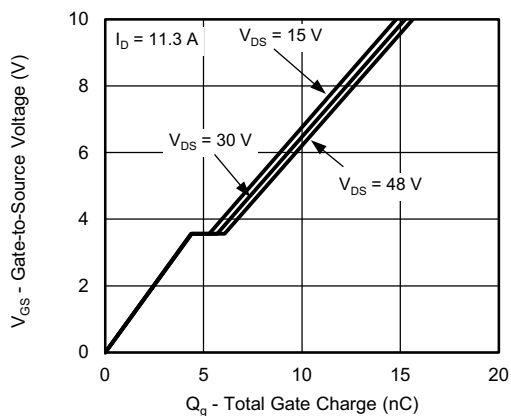
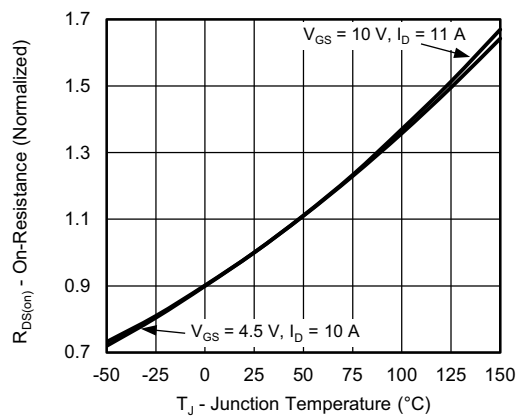
- Package limited
- Surface mounted on 1" x 1" FR4 board
- $t = 10$  s
- The DFN 5x6 package is a leadless package. The end of the lead terminal is exposed copper(not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection
- Rework conditions: manual soldering with a soldering iron is not recommended for leadless components
- Maximum under steady state conditions is 80 °C/W

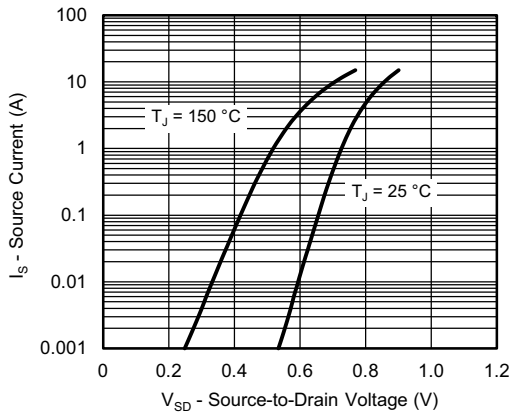
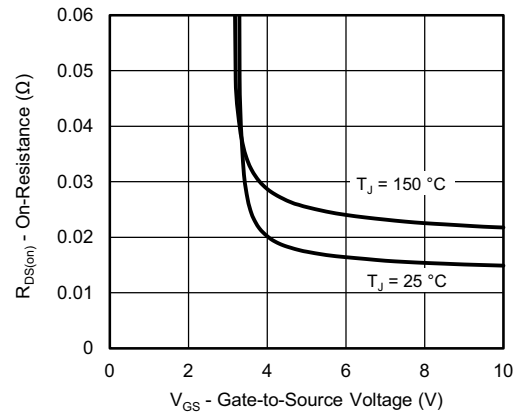
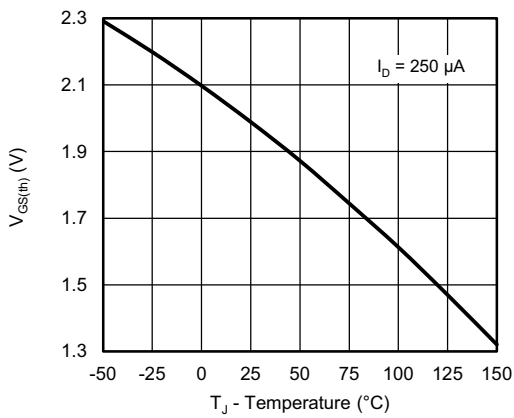
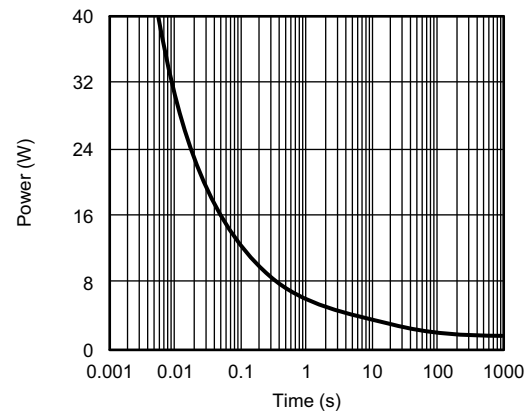
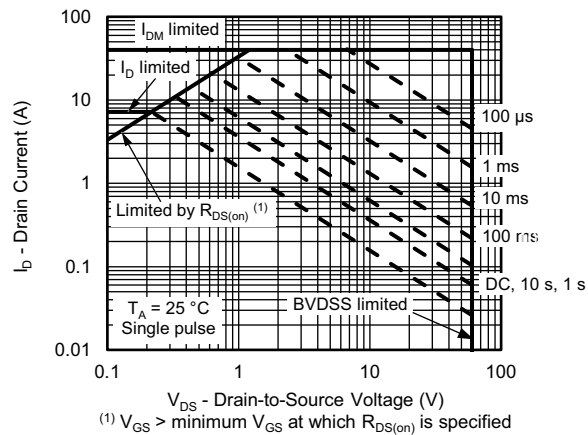
SPECIFICATIONS (T <sub>J</sub> = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-source breakdown voltage	V <sub>DS</sub>	V <sub>GS</sub> = 0 V, I <sub>D</sub> = 250 μA	60	-	-	V
V <sub>DS</sub> temperature coefficient	ΔV <sub>DS</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	38	-	mV/°C
V <sub>GS(th)</sub> temperature coefficient	ΔV <sub>GS(th)</sub> /T <sub>J</sub>	I <sub>D</sub> = 250 μA	-	-4.9	-	
Gate threshold voltage	V <sub>GS(th)</sub>	V <sub>DS</sub> = V <sub>GS</sub> , I <sub>D</sub> = 250 μA	1.2	-	2.7	V
Gate-body leakage	I <sub>GSS</sub>	V <sub>DS</sub> = 0 V, V <sub>GS</sub> = ± 20 V	-	-	100	nA
Zero gate voltage drain current	I <sub>DSS</sub>	V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V	-	-	1	μA
		V <sub>DS</sub> = 60 V, V <sub>GS</sub> = 0 V, T <sub>J</sub> = 85 °C	-	-	10	
On-state drain current <sup>b</sup>	I <sub>D(on)</sub>	V <sub>DS</sub> ≥ 5 V, V <sub>GS</sub> = 10 V	60	-	-	A
Drain-source on-state resistance <sup>b</sup>	R <sub>DS(on)</sub>	V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11 A	-	0.028	-	Ω
		V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 10 A	-	0.038	-	
Forward transconductance <sup>b</sup>	g <sub>fs</sub>	V <sub>DS</sub> = 30 V, I <sub>D</sub> = 11 A	-	38	-	S
Dynamic <sup>a</sup>						
Input capacitance	C <sub>iss</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 0 V, f = 1 MHz	-	1500	-	pF
Output capacitance	C <sub>oss</sub>		-	435	-	
Reverse transfer capacitance	C <sub>rss</sub>		-	20	-	
Total gate charge	Q <sub>g</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 10 V, I <sub>D</sub> = 11 A	-	15.2	23	nC
Gate-source charge	Q <sub>gs</sub>	V <sub>DS</sub> = 30 V, V <sub>GS</sub> = 4.5 V, I <sub>D</sub> = 11 A	-	7.1	11	
Gate-drain charge	Q <sub>gd</sub>		-	4.4	-	
			-	1.3	-	
Gate resistance	R <sub>g</sub>	f = 1 MHz	0.12	0.6	1.2	Ω
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 3.45 Ω I <sub>D</sub> ≅ 8.7 A, V <sub>GEN</sub> = 4.5 V, R <sub>g</sub> = 1 Ω	-	15	120	ns
Rise time	t <sub>r</sub>		-	80	30	
Turn-off delay time	t <sub>d(off)</sub>		-	15	30	
Fall time	t <sub>f</sub>		-	15	30	
Turn-on delay time	t <sub>d(on)</sub>	V <sub>DD</sub> = 30 V, R <sub>L</sub> = 3.45 Ω I <sub>D</sub> ≅ 8.7 A, V <sub>GEN</sub> = 10 V, R <sub>g</sub> = 1 Ω	-	10	15	
Rise time	t <sub>r</sub>		-	25	40	
Turn-off delay time	t <sub>d(off)</sub>		-	20	30	
Fall time	t <sub>f</sub>		-	10	15	
Drain-Source Body Diode Characteristics						
Continuous source-drain diode Current	I <sub>S</sub>	T <sub>C</sub> = 25 °C	-	-	25	A
Pulse diode forward current <sup>a</sup>	I <sub>SM</sub>		-	-	75	
Body diode voltage	V <sub>SD</sub>	I <sub>S</sub> = 8.7 A	-	0.8	1.2	V
Body diode reverse recovery time	t <sub>rr</sub>	I <sub>F</sub> = 8.7 A, di/dt = 100 A/μs, T <sub>J</sub> = 25 °C	-	34	51	ns
Body diode reverse recovery charge	Q <sub>rr</sub>		-	30	45	nC
Reverse recovery fall time	t <sub>a</sub>		-	16	-	ns
Reverse recovery rise time	t <sub>b</sub>		-	18	-	

**Notes**

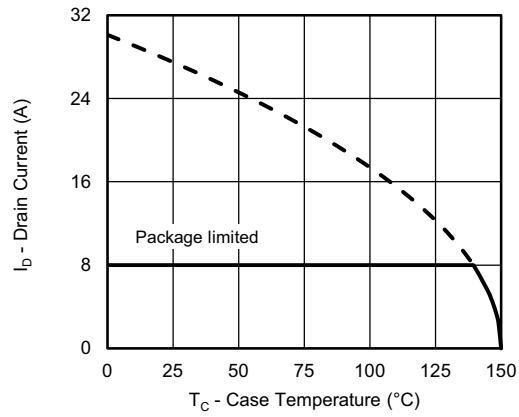
- a. Guaranteed by design, not subject to production testing  
 b. Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

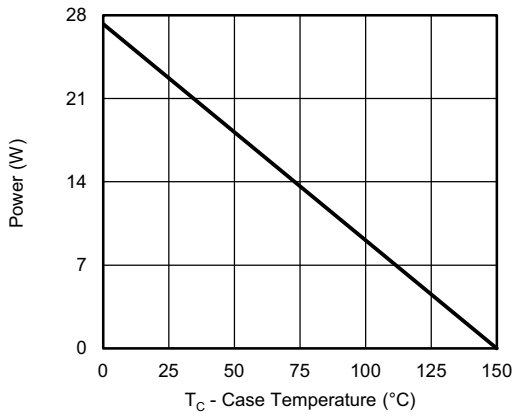
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Output Characteristics**

**Transfer Characteristics**

**On-Resistance vs. Drain Current**

**Capacitance**

**Gate Charge**

**On-Resistance vs. Junction Temperature**

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)

**Source-Drain Diode Forward Voltage**

**On-Resistance vs. Gate-to-Source Voltage**

**Threshold Voltage**

**Single Pulse Power**

**Safe Operating Area, Junction-to-Ambient**

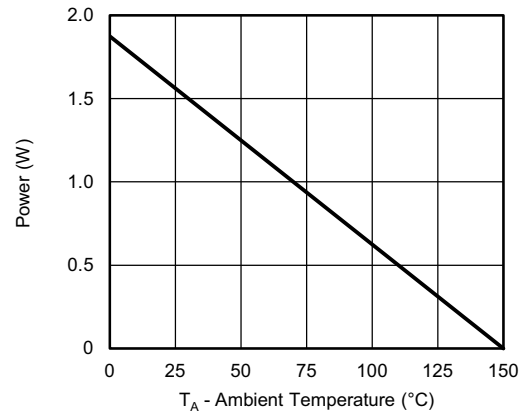
**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Current Derating <sup>a</sup>**



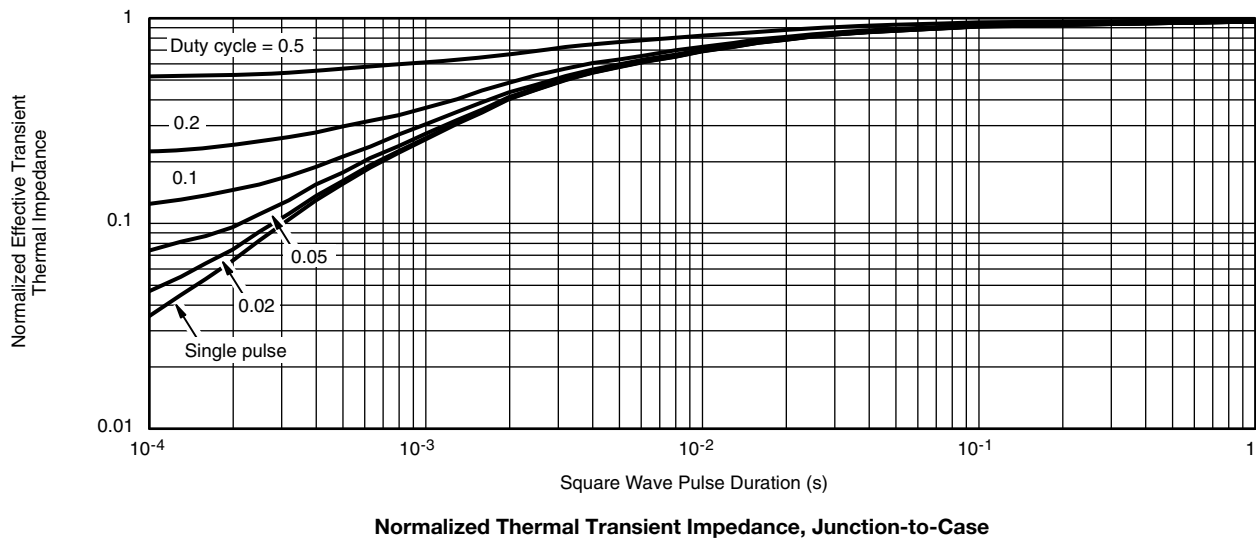
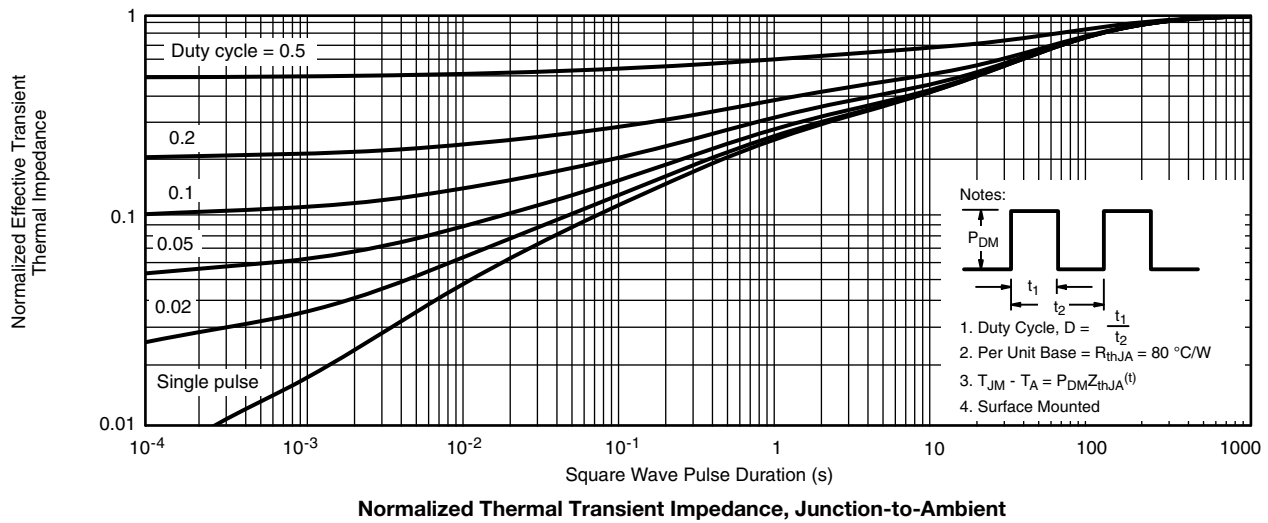
**Power, Junction-to-Case**



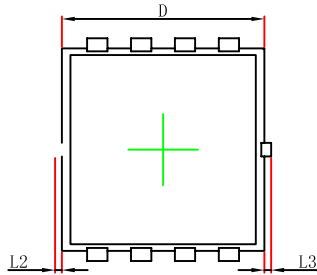
**Power, Junction-to-Ambient**

**Note**

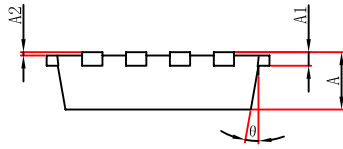
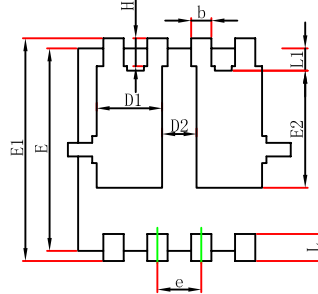
- a. The power dissipation  $P_D$  is based on  $T_J \text{ max.} = 150^\circ\text{C}$ , using junction-to-case thermal resistance, and is more useful in settling the upper dissipation limit for cases where additional heatsinking is used. It is used to determine the current rating, when this rating falls below the package limit

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)


## PDFNWB3.3×3.3-8L-B Package Outline Dimensions



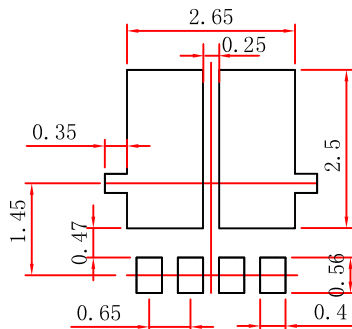
Top View  
[顶视图]



Side View  
[侧视图]

Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.650	0.850	0.026	0.033
A1	0.152 REF.		0.006 REF.	
A2	0~0.05		0~0.002	
D	2.900	3.100	0.114	0.122
D1	0.935	1.135	0.037	0.045
D2	0.280	0.480	0.011	0.019
E	2.900	3.100	0.114	0.122
E1	3.150	3.450	0.124	0.136
E2	1.535	1.935	0.060	0.076
b	0.200	0.400	0.008	0.016
e	0.550	0.750	0.022	0.030
L	0.300	0.500	0.012	0.020
L1	0.180	0.480	0.007	0.019
L2	0~0.100		0~0.004	
L3	0~0.100		0~0.004	
H	0.315	0.515	0.012	0.020
θ	9°	13°	9°	13°

## PDFNWB3.3×3.3-8L-B Suggested 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.

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