

Integrated P-Channel Enhancement Mode Power MOSFET and Schottky Diode

Description

The NCE20PK0402J uses advanced trench technology to provide excellent $R_{DS(ON)}$, low gate charge. A Schottky diode is provided to facilitate the implementation of a bidirectional blocking switch, or for DC-DC conversion applications.

General Features

MOSFET

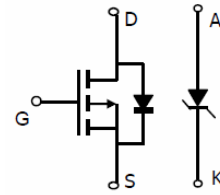
- $V_{DS} = -20V, I_D = -4A$
- $R_{DS(ON)} < 80m\Omega @ V_{GS} = -4.5V$
- $R_{DS(ON)} < 100m\Omega @ V_{GS} = -2.5V$
- $R_{DS(ON)} < 160m\Omega @ V_{GS} = -1.8V$

Schottky Diode

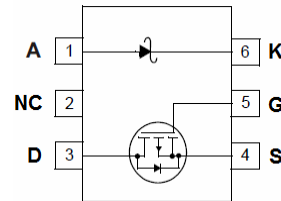
- $V_{KA}(V) = 20V, I_F = 2A, V_F < 0.45V @ 0.5A$

Application

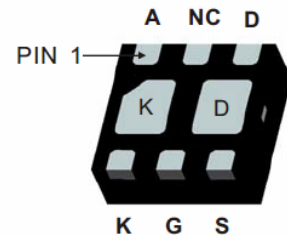
- Bidirectional blocking switch
- DC-DC conversion applications



Schematic diagram



Marking and pin assignment



DFNWB2X2-6L Bottom View

Package Marking and Ordering Information

Device Marking	Device	Device Package	Reel Size	Tape width	Quantity
0402	NCE20PK0402J	DFNWB2X2-6L	Ø180mm	8 mm	3000 units

Absolute Maximum Ratings ($T_A = 25^\circ C$ unless otherwise noted)

Parameter	Symbol	MOSFET	Schottky	Unit
Drain-Source Voltage	V_{DS}	-20		V
Gate-Source Voltage	V_{GS}	± 12		V
Drain Current-Continuous (Note 2)	$T_A = 25^\circ C$	-4		A
	$T_A = 70^\circ C$	-3.1		A
Drain Current - Pulsed (Note 1)		-12		A
Schottky reverse voltage			20	V
Continuous Forward Current (Note 2)	$T_A = 25^\circ C$		2	A
	$T_A = 70^\circ C$		1.5	A
Pulsed Forward Current (Note 1)			6	A
Power Dissipation	$T_A = 25^\circ C$	1.5	1.45	W
	$T_A = 70^\circ C$	0.95	0.92	W
Operating Junction and Storage Temperature Range	T_J, T_{STG}	-55 To 150	-55 To 150	$^\circ C$

Thermal Characteristic

Parameter	Symbol	Typ	Max	Unit
Thermal Resistance, Junction-to-Ambient ^(Note 2) (MOSFET)	$R_{\theta JA}$	85	105	$^{\circ}\text{C/W}$
Thermal Resistance, Junction-to-Ambient ^(Note 2) (Schottky)	$R_{\theta JA}$	87	107	$^{\circ}\text{C/W}$

Electrical Characteristics ($T_A=25^{\circ}\text{C}$ unless otherwise noted)

Parameter		Symbol	Condition	Min	Typ	Max	Unit
Off Characteristics							
Drain-Source Breakdown Voltage		BV _{DSS}	V _{GS} =0V I _D =-250μA	-20		-	V
Zero Gate Voltage Drain Current		I _{DSS}	V _{DS} =-20V, V _{GS} =0V	-	-	-1	μA
Gate-Body Leakage Current		I _{GSS}	V _{GS} =±12V, V _{DS} =0V	-	-	±100	nA
On Characteristics <small>(Note 3)</small>							
Gate Threshold Voltage		V _{GS(th)}	V _{DS} =V _{GS} , I _D =-250μA	-0.4	-0.7	-1	V
Drain-Source On-State Resistance		R _{DS(ON)}	V _{GS} =-4.5V, I _D =-4 A	-	63	80	mΩ
			V _{GS} =-2.5V, I _D =-3A	-	83	100	mΩ
			V _{GS} =-1.8V, I _D =-2A		120	160	mΩ
Forward Transconductance		g _{FS}	V _{DS} =-5V, I _D =-4A		7	-	S
Dynamic Characteristics							
Input Capacitance		C _{iss}	V _{DS} =-10V, V _{GS} =0V, F=1.0MHz	-	500	-	PF
Output Capacitance		C _{oss}		-	70	-	PF
Reverse Transfer Capacitance		C _{rss}		-	55	-	PF
Switching Characteristics							
Turn-on Delay Time		t _{d(on)}	V _{DD} =-10V, R _L =5Ω V _{GS} =-4.5V, R _{GEN} =3Ω	-	7	-	nS
Turn-on Rise Time		t _r		-	15	-	nS
Turn-Off Delay Time		t _{d(off)}		-	29	-	nS
Turn-Off Fall Time		t _f		-	20	-	nS
Total Gate Charge		Q _g	V _{DS} =-10V, I _D =-4A, V _{GS} =-4.5V	-	5	-	nC
Gate-Source Charge		Q _{gs}		-	1.1	-	nC
Gate-Drain Charge		Q _{gd}		-	1	-	nC
Drain-Source Diode Characteristics							
Diode Forward Voltage		V _{SD}	I _F =-4A	-	-	-1.2	V
Diode Forward Current		I _S		-	-	-1.2	A
Schottky Parameter							
Forward Voltage Drop		V _F	V _{GS} =0V, I _S =0.5A	-	0.43	0.45	V
Reverse Breakdown Voltage		V _{BR}	I _R =100μA	20			V
Maximum reverse leakage current	T _J =25°C	I _{rm}	V _R =20V	-	20	100	μA
	T _J =125°C				5.1	10	mA
Junction Capacitance		C _T	V _R =10V	-	35	-	pF

Notes:

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. The value of $R_{\theta JA}$ is measured with the device mounted on 1in 2 FR-4 board with 2oz. Copper, in a still air environment with $T_A=25^{\circ}\text{C}$. The value in any given application depends on the user's specific board design. Surface Mounted on FR4 Board, $t \leq 10$ sec. The current rating is based on the $t \leq 10$ s thermal resistance rating.
3. Pulse Test: Pulse Width $\leq 300\mu s$, Duty Cycle $\leq 2\%$.
4. Guaranteed by design, not subject to production

Typical Electrical and Thermal Characteristics : MOSFET

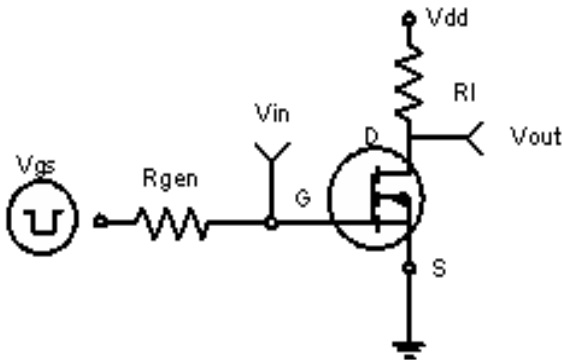


Figure 1: Switching Test Circuit

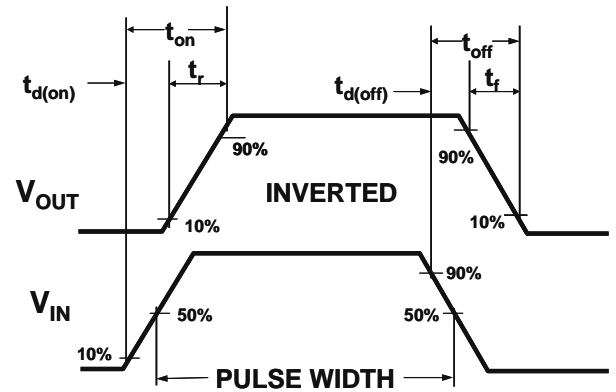


Figure 2: Switching Waveforms

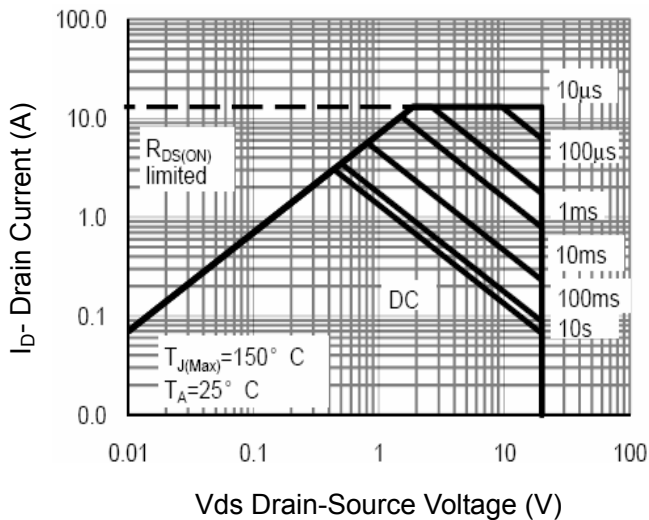


Figure 3 Safe Operation Area

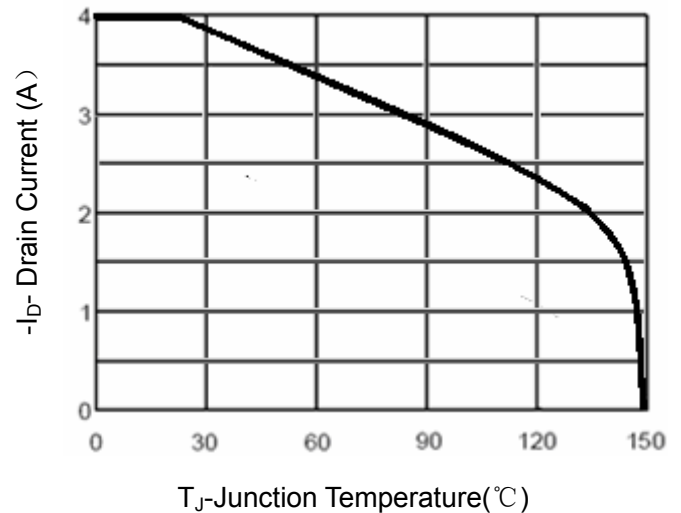


Figure 4 Drain Current

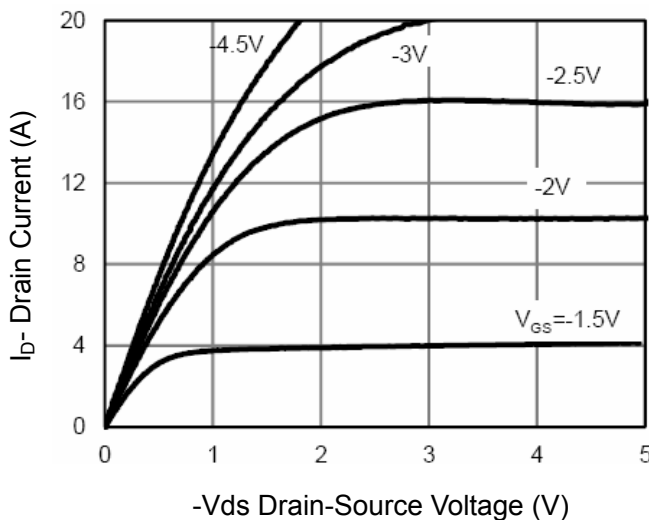


Figure 5 Output Characteristics

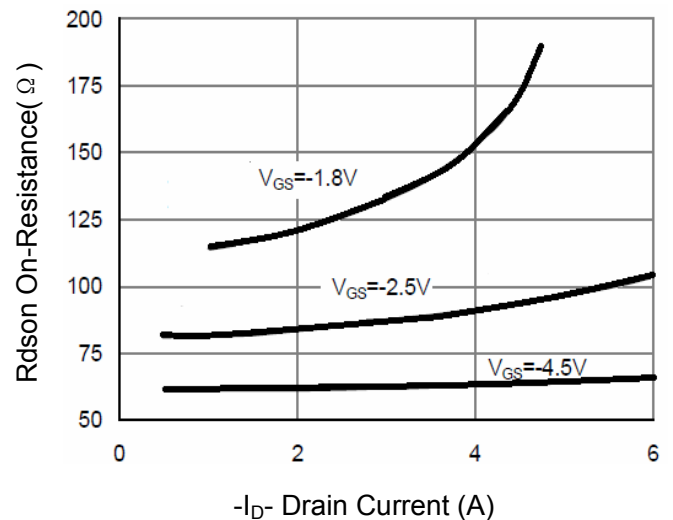


Figure 6 Drain-Source On-Resistance

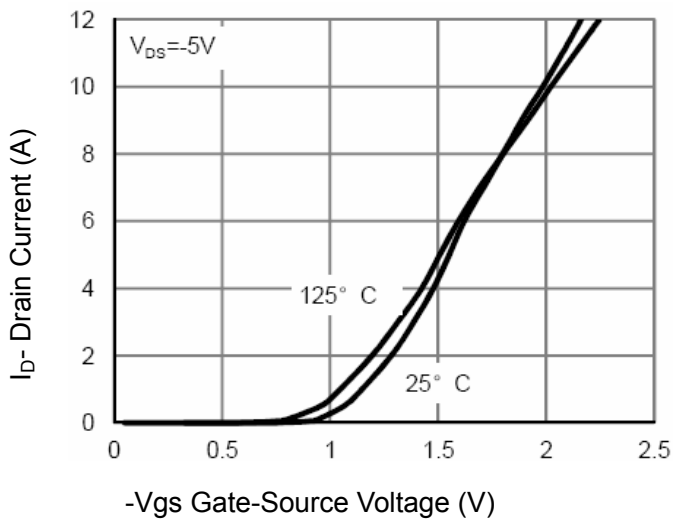


Figure 7 Transfer Characteristics

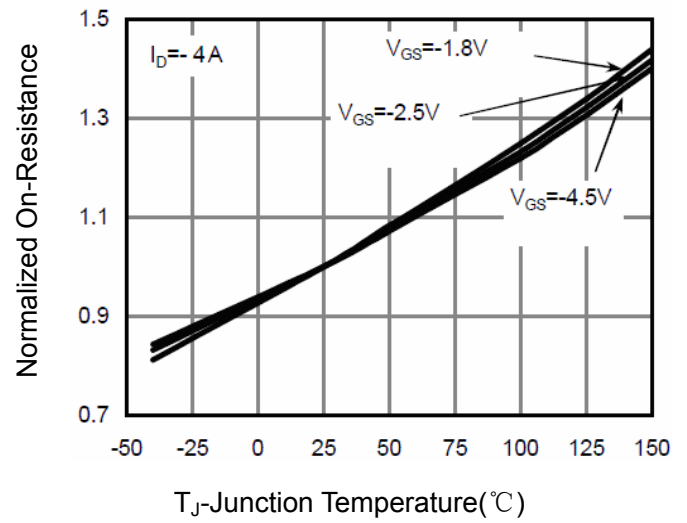


Figure 8 Drain-Source On-Resistance

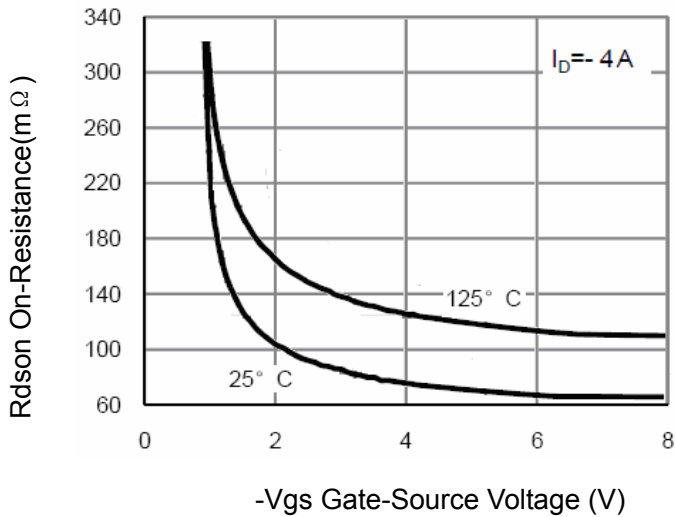


Figure 9 Rdson vs Vgs

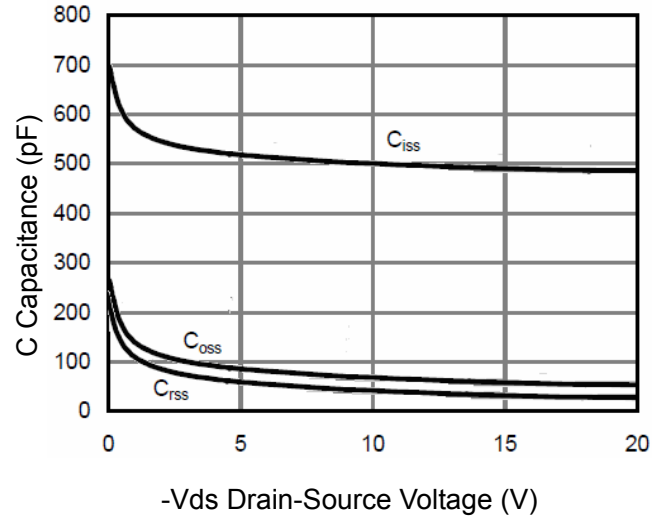


Figure 10 Capacitance vs Vds

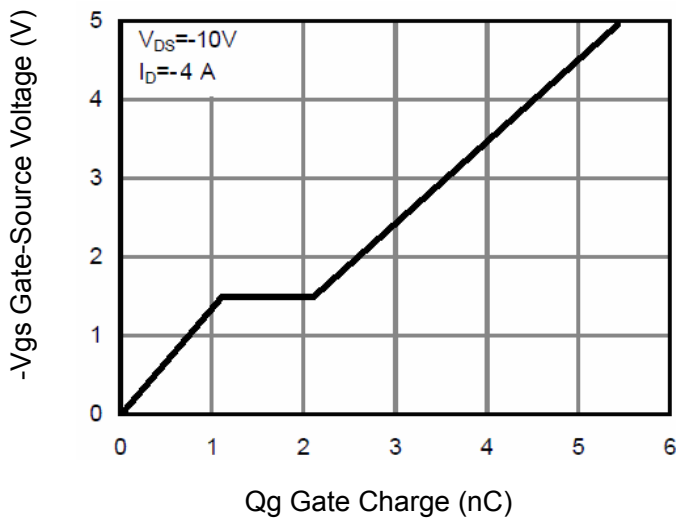


Figure 11 Gate Charge

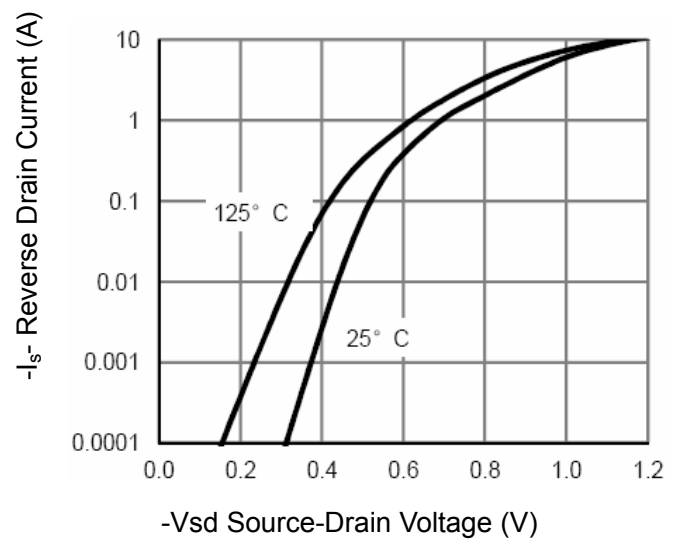


Figure 12 Source- Drain Diode Forward

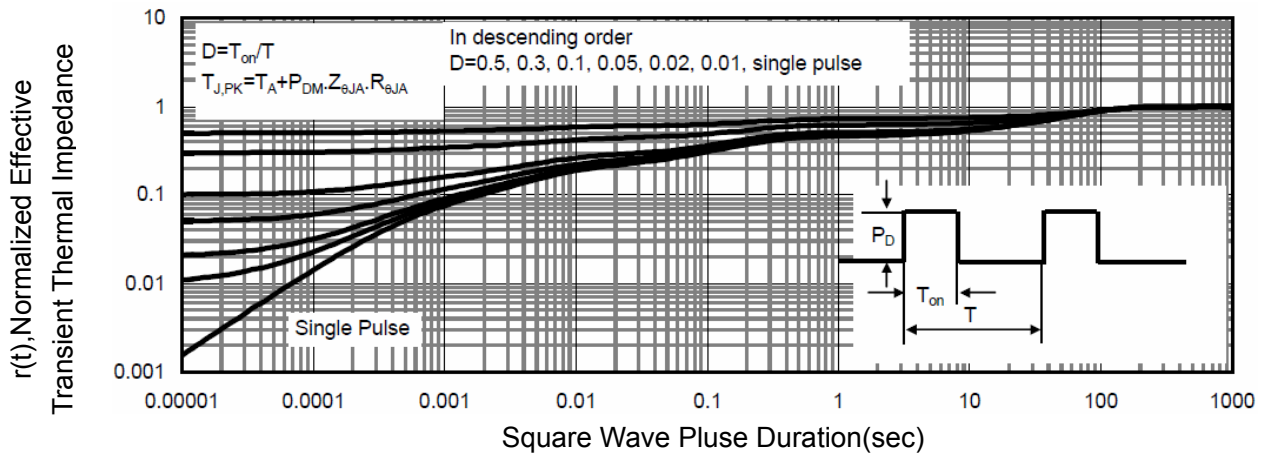


Figure 13 Normalized Maximum Transient Thermal Impedance

Typical Electrical and Thermal Characteristics : Schottky

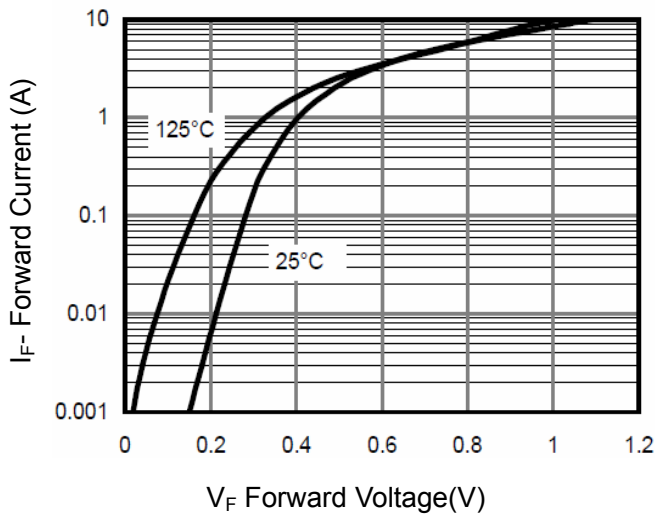


Figure 14 Schottky Forward Characteristics

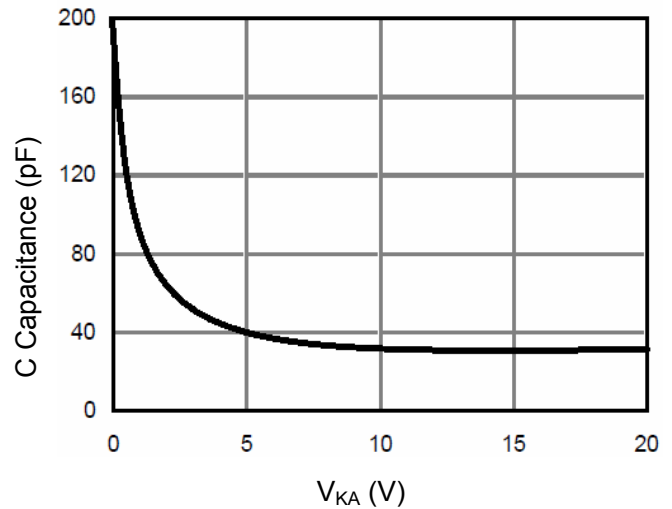


Figure 15 Schottky Capacitance

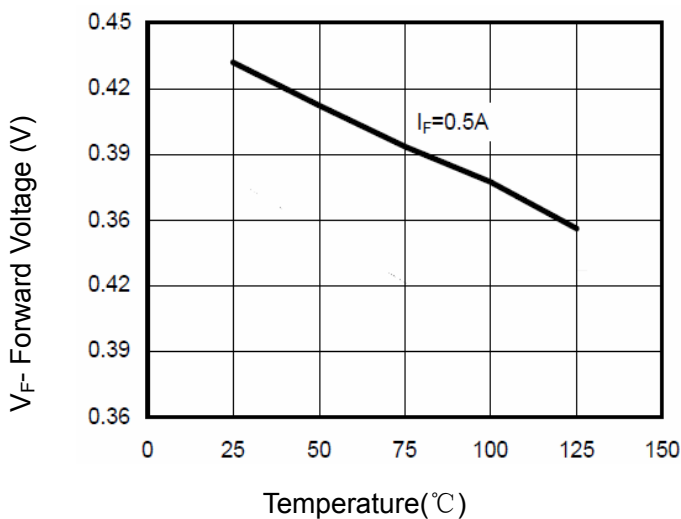


Figure 16 Schottky Forward vs. Junction Temperature

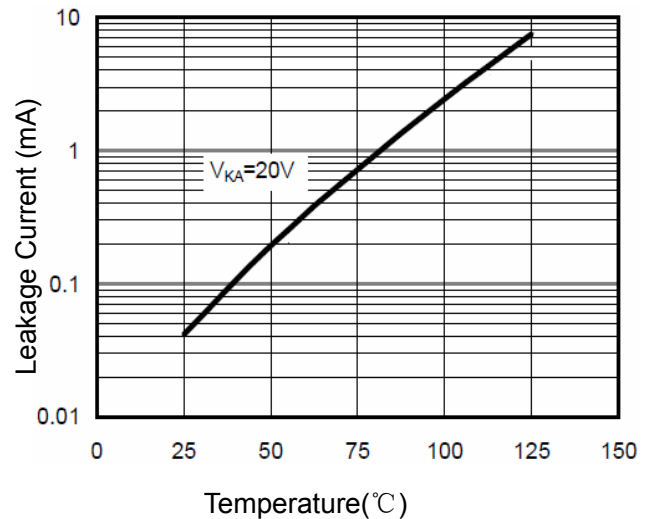
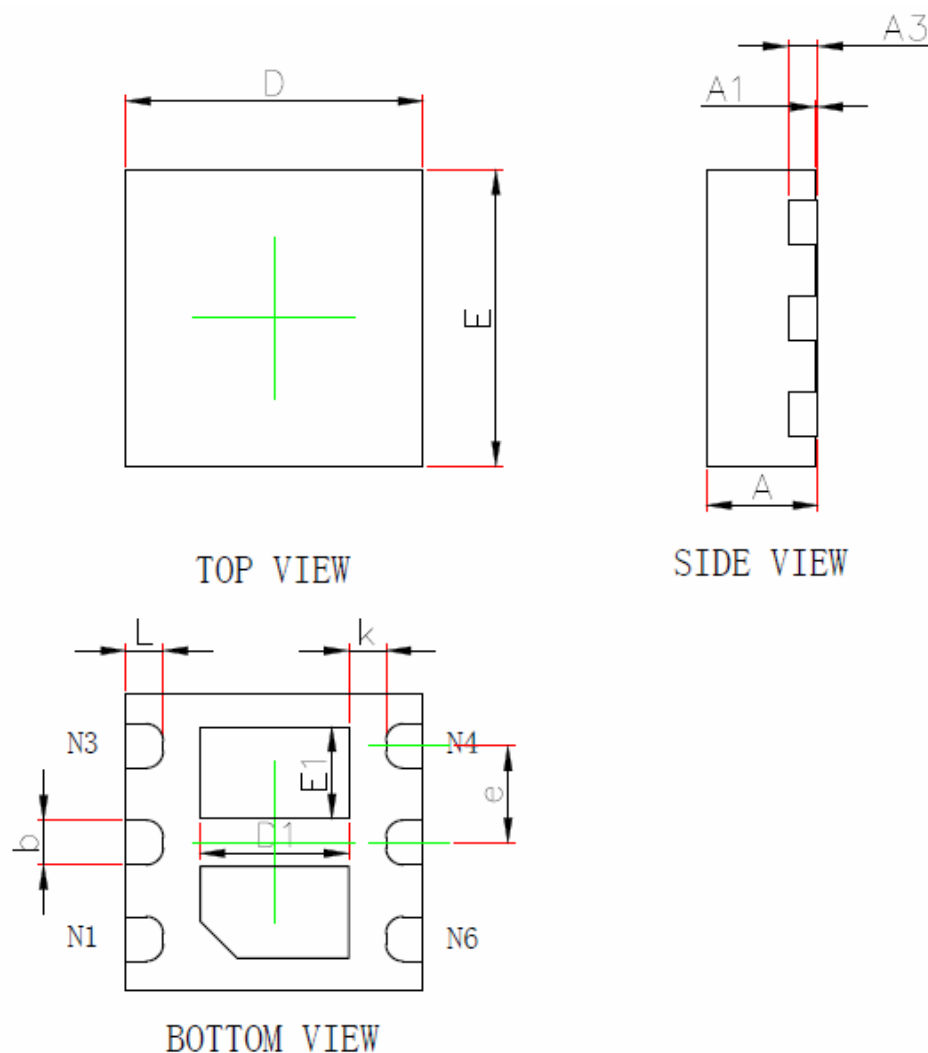


Figure 17 Schottky Forward vs. Junction Temperature

DFNWB2X2-6L Package Information



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	0.700	0.800	0.028	0.031
A1	0.000	0.050	0.000	0.002
A3	0.203REF.		0.008REF.	
D	1.900	2.100	0.075	0.083
E	1.900	2.100	0.075	0.083
D1	0.900	1.100	0.035	0.043
E1	0.520	0.720	0.020	0.028
b	0.250	0.350	0.010	0.014
e	0.650TYP.		0.026TYP.	
k	0.200MIN.		0.008MIN.	
L	0.200	0.300	0.008	0.012

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