

NCEP4060EQ-VB Datasheet

N-Channel 40 V (D-S) MOSFET

PRODUCT SUMMARY

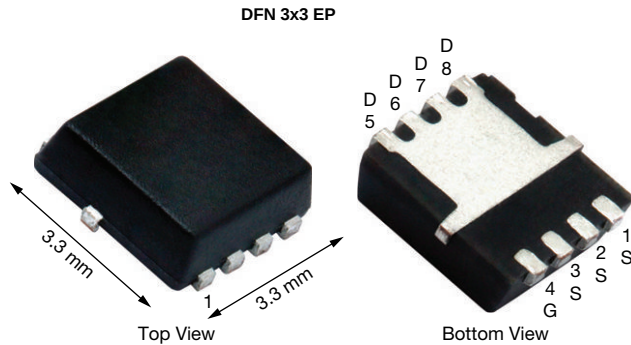
V_{DS} (V)	$R_{DS(on)}$ (Ω)	I_D (A) ^{f, g}	Q_g (TYP.)
40	0.002 at $V_{GS} = 10$ V	60	19.5 nC
	0.0024 at $V_{GS} = 4.5$ V	60	

FEATURES

- TrenchFET® Gen IV power MOSFET
- 100 % R_g and UIS tested
- Tuned for the lowest $R_{DS}-Q_{oss}$ FOM

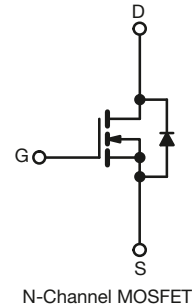


RoHS
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APPLICATIONS

- DC/DC power supplies
- Synchronous rectification
- Motor drive control
- Telecom POL and bricks
- Battery protection



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

PARAMETER		SYMBOL	LIMIT	UNIT
Drain-Source Voltage		V_{DS}	40	V
Gate-Source Voltage		V_{GS}	+20, -16	
Continuous Drain Current ($T_J = 150$ °C)	$T_C = 25$ °C	I_D	60 ^g	A
	$T_C = 70$ °C		60 ^g	
	$T_A = 25$ °C		24.2 ^{a, b}	
	$T_A = 70$ °C		19.5 ^{a, b}	
Pulsed Drain Current ($t = 100$ μ s)		I_{DM}	150	
Continuous Source-Drain Diode Current	$T_C = 25$ °C	I_S	47.2	
	$T_A = 25$ °C		3.3 ^{a, b}	
Single Pulse Avalanche Current	L = 0.1 mH	I_{AS}	20	mJ
Single Pulse Avalanche Energy		E_{AS}	20	
Maximum Power Dissipation	$T_C = 25$ °C	P_D	52	W
	$T_C = 70$ °C		33.3	
	$T_A = 25$ °C		3.7 ^{a, b}	
	$T_A = 70$ °C		2.4 ^{a, b}	
Operating Junction and Storage Temperature Range		T_J, T_{stg}	-55 to 150	°C
Soldering Recommendations (Peak Temperature) ^{c, d}			260	

THERMAL RESISTANCE RATINGS

PARAMETER		SYMBOL	TYPICAL	MAXIMUM	UNIT
Maximum Junction-to-Ambient ^{a, e}	$t \leq 10$ s	R_{thJA}	24	33	°C/W
Maximum Junction-to-Case (Drain)	Steady State	R_{thJC}	1.9	2.4	

Notes

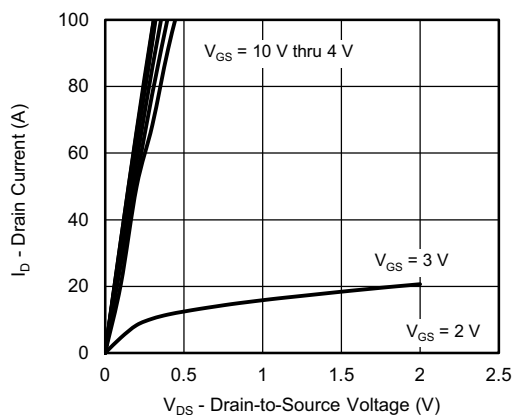
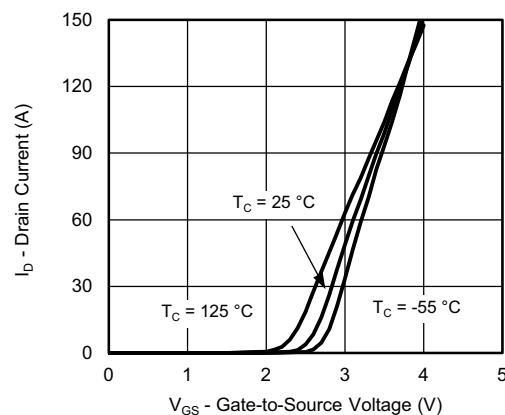
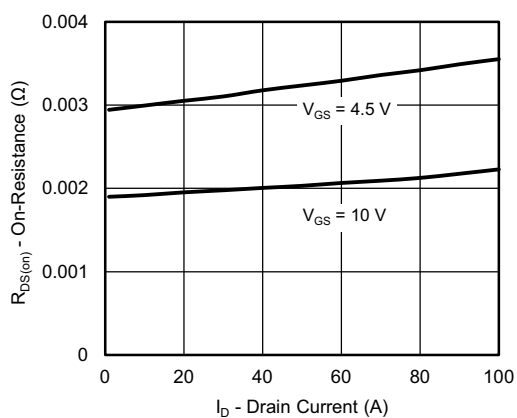
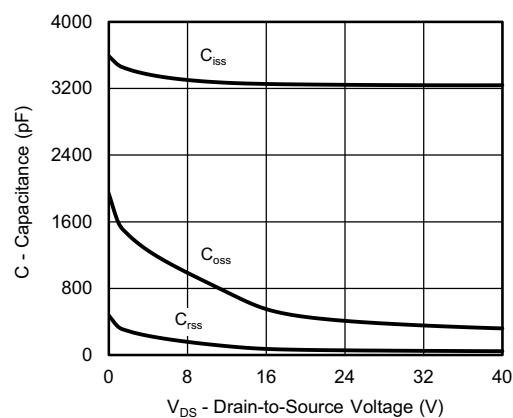
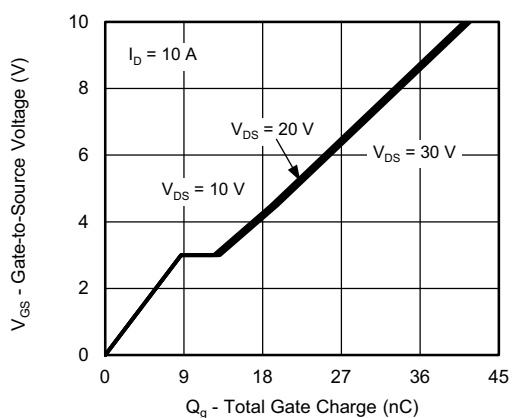
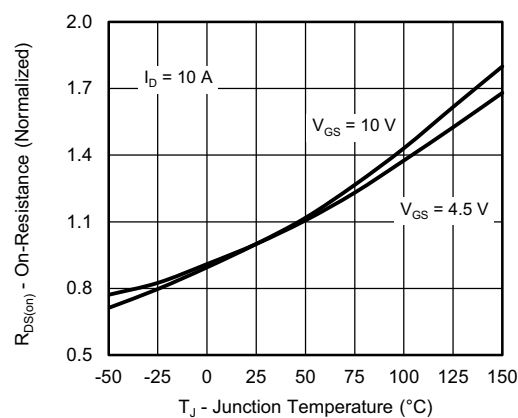
- Surface mounted on 1" x 1" FR4 board.
- $t = 10$ s.
- The DFN3x3 package is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper tip cannot be guaranteed and is not required to 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 81 °C/W.
- Based on $T_C = 25$ °C.
- Package limited.

SPECIFICATIONS (T _J = 25 °C, unless otherwise noted)						
PARAMETER	SYMBOL	TEST CONDITIONS	MIN.	TYP.	MAX.	UNIT
Static						
Drain-Source Breakdown Voltage	V _{DS}	V _{GS} = 0 V, I _D = 250 μA	40	-	-	V
V _{DS} Temperature Coefficient	ΔV _{DS} /T _J	I _D = 250 μA	-	25	-	mV/°C
V _{GS(th)} Temperature Coefficient	ΔV _{GS(th)} /T _J		-	-5.3	-	
Gate-Source Threshold Voltage	V _{GS(th)}	V _{DS} = V _{GS} , I _D = 250 μA	1.1	-	2.4	V
Gate-Source Leakage	I _{GSS}	V _{DS} = 0 V, V _{GS} = +20 V, -16 V	-	-	± 100	nA
Zero Gate Voltage Drain Current	I _{DSS}	V _{DS} = 40 V, V _{GS} = 0 V	-	-	1	μA
		V _{DS} = 40 V, V _{GS} = 0 V, T _J = 55 °C	-	-	10	
On-State Drain Current ^a	I _{D(on)}	V _{DS} ≥ 5 V, V _{GS} = 10 V	30	-	-	A
Drain-Source On-State Resistance ^a	R _{DS(on)}	V _{GS} = 10 V, I _D = 10 A	-	0.0020	-	Ω
		V _{GS} = 4.5 V, I _D = 10 A	-	0.0024	-	
Forward Transconductance ^a	g _{fs}	V _{DS} = 15 V, I _D = 10 A	-	70	-	S
Dynamic ^b						
Input Capacitance	C _{iss}	V _{DS} = 20 V, V _{GS} = 0 V, f = 1 MHz	-	3240	-	pF
Output Capacitance	C _{oss}		-	455	-	
Reverse Transfer Capacitance	C _{rss}		-	60	-	
C _{rss} /C _{iss} Ratio			-	0.026	0.052	-
Total Gate Charge	Q _g	V _{DS} = 20 V, V _{GS} = 10 V, I _D = 10 A	-	41.5	63	nC
		V _{DS} = 20 V, V _{GS} = 4.5 V, I _D = 10 A	-	19.5	30	
Gate-Source Charge	Q _{gs}		-	8.7	-	
Gate-Drain Charge	Q _{gd}		-	4.2	-	
Output Charge	Q _{oss}	V _{DS} = 20 V, V _{GS} = 0 V	-	18.5	-	
Gate Resistance	R _g	f = 1 MHz	0.5	1.4	2.5	Ω
Turn-On Delay Time	t _{d(on)}	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 10 V, R _g = 1 Ω	-	10	20	ns
Rise Time	t _r		-	20	40	
Turn-Off Delay Time	t _{d(off)}		-	24	48	
Fall Time	t _f		-	7	14	
Turn-On Delay Time	t _{d(on)}	V _{DD} = 20 V, R _L = 2 Ω I _D ≅ 10 A, V _{GEN} = 4.5 V, R _g = 1 Ω	-	29	58	
Rise Time	t _r		-	85	170	
Turn-Off Delay Time	t _{d(off)}		-	30	60	
Fall Time	t _f		-	35	70	
Drain-Source Body Diode Characteristics						
Continuous Source-Drain Diode Current	I _S	T _C = 25 °C	-	-	47.5	A
Pulse Diode Forward Current (t = 100 μs)	I _{SM}		-	-	150	
Body Diode Voltage	V _{SD}	I _S = 5 A, V _{GS} = 0 V	-	0.74	1.1	V
Body Diode Reverse Recovery Time	t _{rr}	I _F = 10 A, dI/dt = 100 A/μs, T _J = 25 °C	-	31	62	ns
Body Diode Reverse Recovery Charge	Q _{rr}		-	23	46	nC
Reverse Recovery Fall Time	t _a		-	15	-	ns
Reverse Recovery Rise Time	t _b		-	16	-	

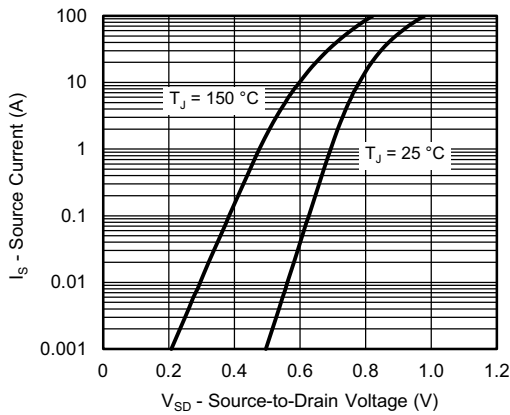
Notes

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

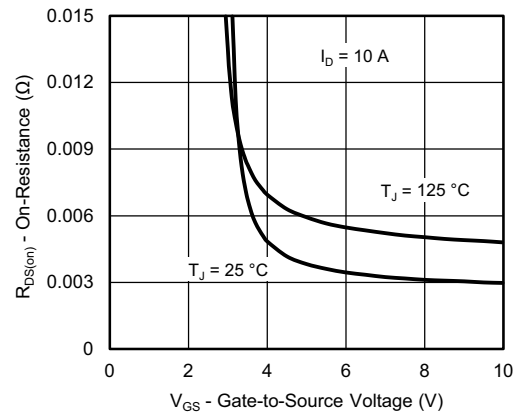
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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

TYPICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Output Characteristics

Transfer Characteristics

On-Resistance vs. Drain Current and Gate Voltage

Capacitance

Gate Charge

On-Resistance vs. Junction Temperature

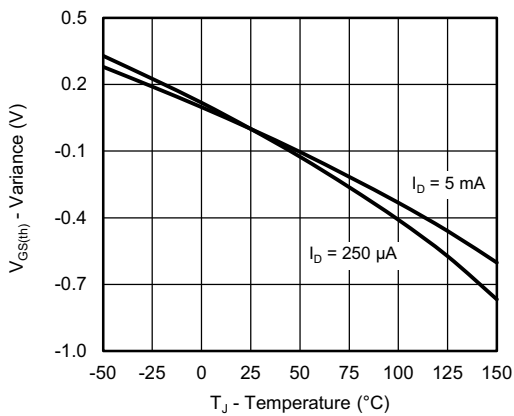
TYPICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)



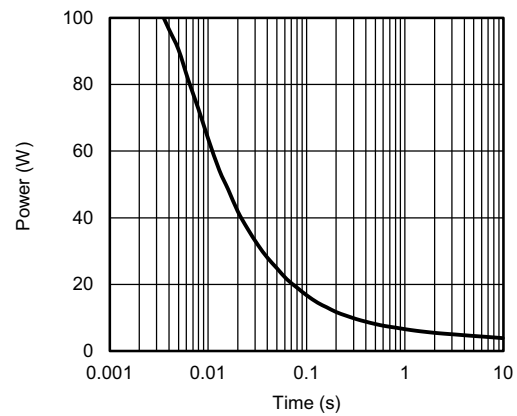
Source-Drain Diode Forward Voltage



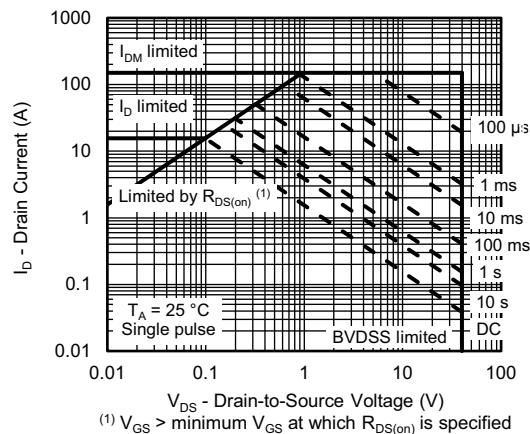
On-Resistance vs. Gate-to-Source Voltage



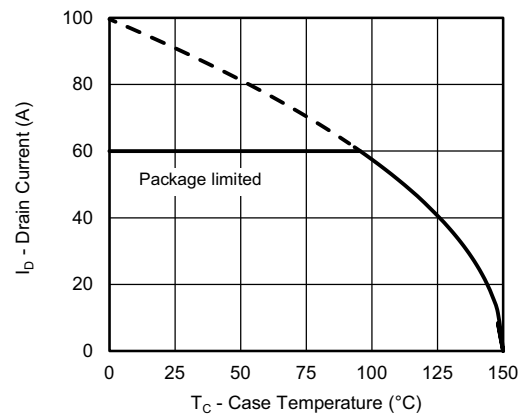
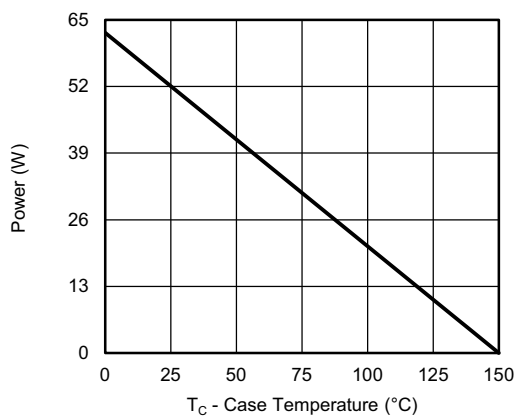
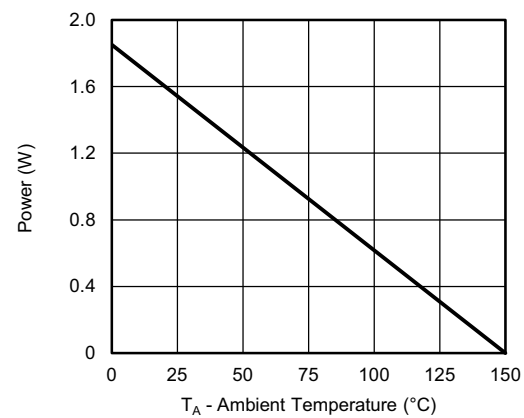
Threshold Voltage



Single Pulse Power, Junction-to-Ambient

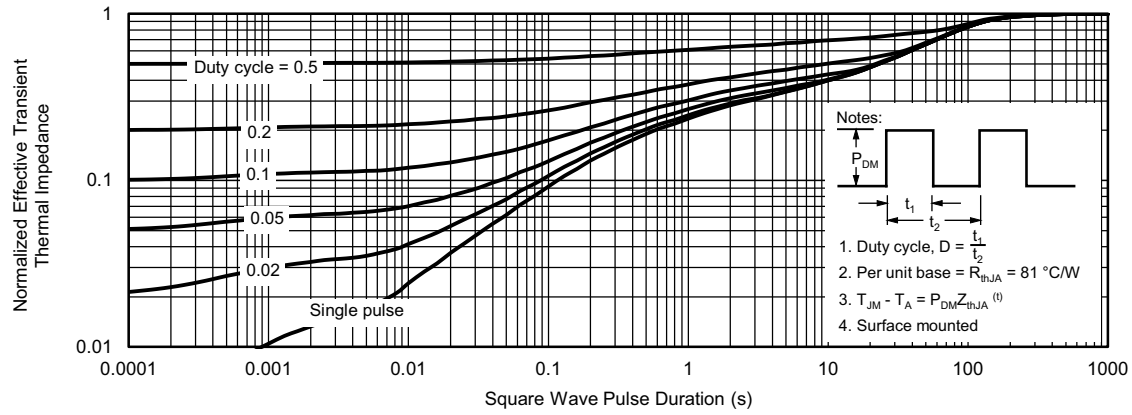


Safe Operating Area, Junction-to-Ambient

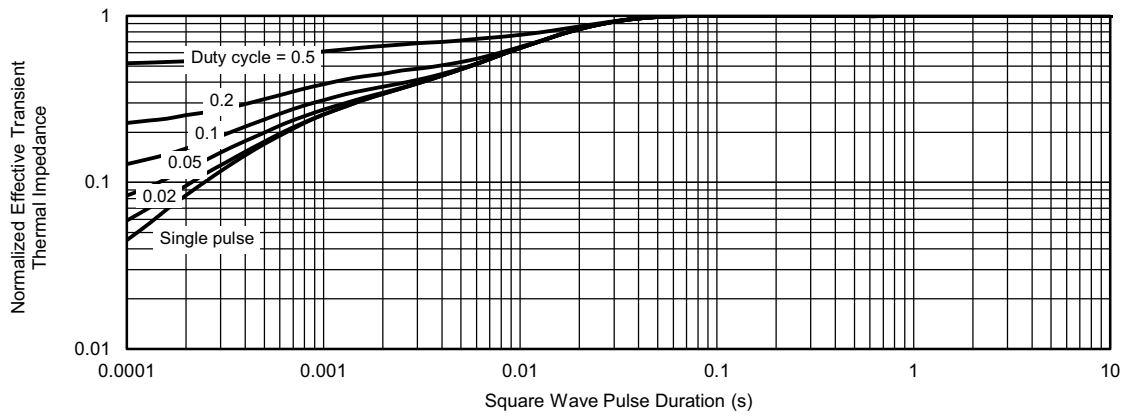
TYPICAL CHARACTERISTICS ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

Current Derating ^a

Power, Junction-to-Case

Power, Junction-to-Ambient
Note

- a. The power dissipation P_D is based on T_J (max.) = $150\text{ }^{\circ}\text{C}$, 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 ($T_J = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

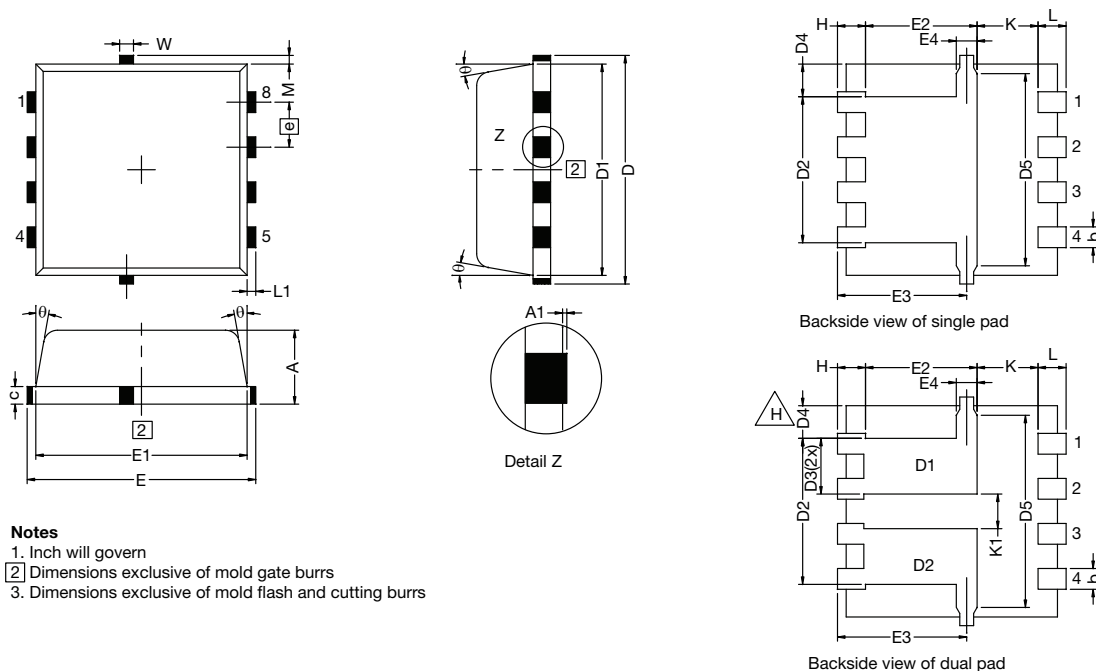


Normalized Thermal Transient Impedance, Junction-to-Ambient



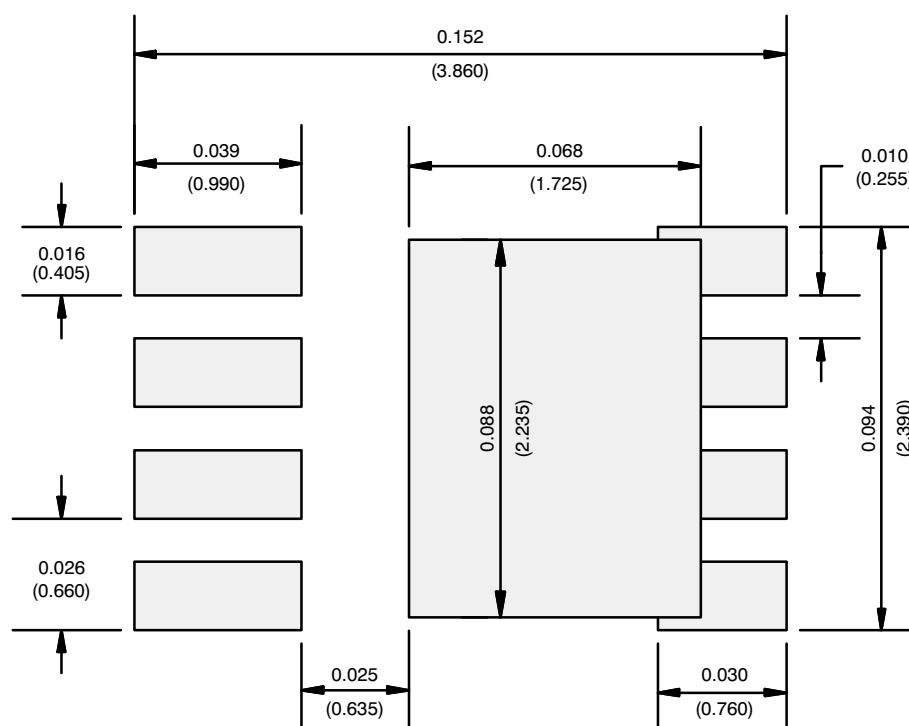
Normalized Thermal Transient Impedance, Junction-to-Case

DFN3x3, (Single / Dual)



DIM.	MILLIMETERS			INCHES		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.97	1.04	1.12	0.038	0.041	0.044
A1	0.00	-	0.05	0.000	-	0.002
b	0.23	0.30	0.41	0.009	0.012	0.016
c	0.23	0.28	0.33	0.009	0.011	0.013
D	3.20	3.30	3.40	0.126	0.130	0.134
D1	2.95	3.05	3.15	0.116	0.120	0.124
D2	1.98	2.11	2.24	0.078	0.083	0.088
D3	0.48	-	0.89	0.019	-	0.035
D4	0.47 typ.			0.0185 typ		
D5	2.3 typ.			0.090 typ		
E	3.20	3.30	3.40	0.126	0.130	0.134
E1	2.95	3.05	3.15	0.116	0.120	0.124
E2	1.47	1.60	1.73	0.058	0.063	0.068
E3	1.75	1.85	1.98	0.069	0.073	0.078
E4	0.034 typ.			0.013 typ.		
e	0.65 BSC			0.026 BSC		
K	0.86 typ.			0.034 typ.		
K1	0.35	-	-	0.014	-	-
H	0.30	0.41	0.51	0.012	0.016	0.020
L	0.30	0.43	0.56	0.012	0.017	0.022
L1	0.06	0.13	0.20	0.002	0.005	0.008
θ	0°	-	12°	0°	-	12°
W	0.15	0.25	0.36	0.006	0.010	0.014
M	0.125 typ.			0.005 typ.		
ECN: S16-2667-Rev. M, 09-Jan-17						
DWG: 5882						

RECOMMENDED MINIMUM PADS FOR DFN 3x3



Recommended Minimum Pads
Dimensions in Inches/(mm)

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