

Silicon Carbide (SiC) MOSFET – EliteSiC, 33 mohm, 650 V, M2, Power88

NTMT045N065SC1

Features

- Typ. $R_{DS(on)} = 33 \text{ m}\Omega$ @ $V_{GS} = 18 \text{ V}$
Typ. $R_{DS(on)} = 45 \text{ m}\Omega$ @ $V_{GS} = 15 \text{ V}$
- Ultra Low Gate Charge ($Q_{G(tot)} = 105 \text{ nC}$)
- Low Effective Output Capacitance ($C_{oss} = 162 \text{ pF}$)
- 100% Avalanche Tested
- $T_J = 175^\circ\text{C}$
- RoHS Compliant

Typical Applications

- SMPS (Switching Mode Power Supplies)
- Solar Inverters
- UPS (Uninterruptible Power Supplies)
- Energy Storage

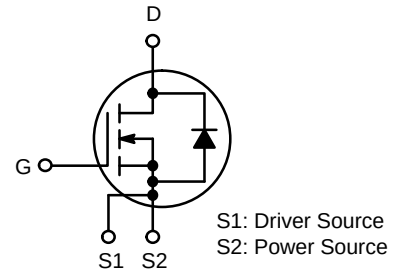
MAXIMUM RATINGS ($T_J = 25^\circ\text{C}$ unless otherwise noted)

Parameter			Symbol	Value	Unit
Drain-to-Source Voltage			V_{DSS}	650	V
Gate-to-Source Voltage			V_{GS}	-8/+22	V
Recommended Operation Values of Gate – Source Voltage		$T_C < 175^{\circ}\text{C}$	V_{GSop}	-5/+18	V
Continuous Drain Current (Note 2)	Steady State	$T_C = 25^{\circ}\text{C}$	I_D	55	A
Power Dissipation (Note 2)			P_D	187	W
Continuous Drain Current (Notes 1, 2)	Steady State	$T_C = 100^{\circ}\text{C}$	I_D	39	A
Power Dissipation (Notes 1, 2)			P_D	94	W
Pulsed Drain Current (Note 3)		$T_C = 25^{\circ}\text{C}$	I_{DM}	197	A
Operating Junction and Storage Temperature Range			T_J, T_{stg}	-55 to +175	$^{\circ}\text{C}$
Source Current (Body Diode)			I_S	45	A
Single Pulse Drain-to-Source Avalanche Energy ($I_L = 12 A_{pk}$, $L = 1 \text{ mH}$) (Note 4)			E_{AS}	72	mJ
Maximum Lead Temperature for Soldering, 1/8" from Case for 10 Seconds			T_L	260	$^{\circ}\text{C}$

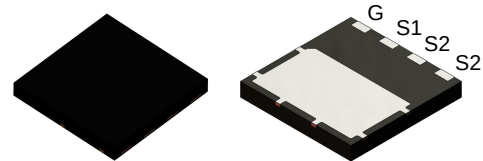
Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

- Surface mounted on a FR-4 board using 1 in2 pad of 2 oz copper.
- The entire application environment impacts the thermal resistance values shown, they are not constants and are only valid for the particular conditions noted.
- Repetitive rating, limited by max junction temperature.
- E_{AS} of 72 mJ is based on starting $T_J = 25^\circ\text{C}$; $L = 1 \text{ mH}$, $I_{AS} = 12 \text{ A}$, $V_{DD} = 50 \text{ V}$, $V_{GS} = 18 \text{ V}$.

V_{DSS}	$R_{DS(on)} \text{ MAX}$	$I_D \text{ MAX}$
650 V	50 m Ω @ 18 V	55 A

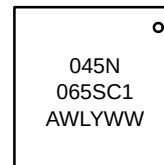


POWER MOSFET



TDFN4 8x8 2P
CASE 520AB

MARKING DIAGRAM



045N065SC1 = Specific Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week

ORDERING INFORMATION

Device	Package	Shipping†
NTMT045N065SC1	TDFN4 (Pb-Free)	3000 / Tape & Reel

†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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THERMAL CHARACTERISTICS

Parameter	Symbol	Max	Unit
Junction-to-Case – Steady State (Note 2)	$R_{\theta JC}$	0.80	°C/W
Junction-to-Ambient – Steady State (Notes 1, 2)	$R_{\theta JA}$	45	°C/W

ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise stated)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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OFF CHARACTERISTICS

Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	$V_{GS} = 0\text{ V}, I_D = 1\text{ mA}$	650	–	–	V
Drain-to-Source Breakdown Voltage Temperature Coefficient	$V_{(BR)DSS}/T_J$	$I_D = 20\text{ mA}$, refer to 25°C	–	0.15	–	V/°C
Zero Gate Voltage Drain Current	I_{DSS}	$V_{GS} = 0\text{ V}, V_{DS} = 650\text{ V}$	$T_J = 25^\circ\text{C}$	–	–	10 μA
			$T_J = 175^\circ\text{C}$	–	–	1 mA
Gate-to-Source Leakage Current	I_{GSS}	$V_{GS} = +18/-5\text{ V}, V_{DS} = 0\text{ V}$	–	–	250	nA

ON CHARACTERISTICS

Gate Threshold Voltage	$V_{GS(TH)}$	$V_{GS} = V_{DS}, I_D = 8\text{ mA}$	1.8	2.8	4.3	V
Recommended Gate Voltage	V_{GOP}		–5	–	+18	V
Drain-to-Source On Resistance	$R_{DS(on)}$	$V_{GS} = 15\text{ V}, I_D = 25\text{ A}, T_J = 25^\circ\text{C}$	–	45	–	m Ω
		$V_{GS} = 18\text{ V}, I_D = 25\text{ A}, T_J = 25^\circ\text{C}$	–	33	50	
		$V_{GS} = 18\text{ V}, I_D = 25\text{ A}, T_J = 175^\circ\text{C}$	–	40	–	
Forward Transconductance	g_{FS}	$V_{DS} = 10\text{ V}, I_D = 25\text{ A}$	–	16	–	S

CHARGES, CAPACITANCES & GATE RESISTANCE

Input Capacitance	C_{ISS}	$V_{GS} = 0\text{ V}, f = 1\text{ MHz}, V_{DS} = 325\text{ V}$	–	1870	–	pF
Output Capacitance	C_{OSS}		–	162	–	
Reverse Transfer Capacitance	C_{RSS}		–	14	–	
Total Gate Charge	$Q_{G(TOT)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 520\text{ V}, I_D = 25\text{ A}$	–	105	–	nC
Gate-to-Source Charge	Q_{GS}		–	27	–	
Gate-to-Drain Charge	Q_{GD}		–	30	–	
Gate-Resistance	R_G	$f = 1\text{ MHz}$	–	3.1	–	Ω

SWITCHING CHARACTERISTICS

Turn-On Delay Time	$t_{d(ON)}$	$V_{GS} = -5/18\text{ V}, V_{DS} = 400\text{ V}, I_D = 25\text{ A}, R_G = 2.2\text{ }\Omega$, Inductive Load	–	13	–	ns
Rise Time	t_r		–	14	–	
Turn-Off Delay Time	$t_{d(OFF)}$		–	26	–	
Fall Time	t_f		–	7	–	
Turn-On Switching Loss	E_{ON}		–	47	–	μJ
Turn-Off Switching Loss	E_{OFF}		–	33	–	
Total Switching Loss	E_{TOT}		–	80	–	

SOURCE-DrAIN DIODE CHARACTERISTICS

Continuous Source-Drain Diode Forward Current	I_{SD}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$	–	–	45	A
Pulsed Source-Drain Diode Forward Current (Note 3)	I_{SDM}	$V_{GS} = -5\text{ V}, T_J = 25^\circ\text{C}$	–	–	197	A
Forward Diode Voltage	V_{SD}	$V_{GS} = -5\text{ V}, I_{SD} = 25\text{ A}, T_J = 25^\circ\text{C}$	–	4.4	–	V

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ELECTRICAL CHARACTERISTICS ($T_J = 25^\circ\text{C}$ unless otherwise stated) (continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
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SOURCE-DRAIN DIODE CHARACTERISTICS

Reverse Recovery Time	t_{RR}	$V_{GS} = -5/18\text{ V}, I_{SD} = 25\text{ A},$ $dI_S/dt = 1000\text{ A}/\mu\text{s}$	–	20	–	ns
Reverse Recovery Charge	Q_{RR}		–	108	–	nC
Reverse Recovery Energy	E_{REC}		–	4.5	–	μJ
Peak Reverse Recovery Current	I_{RRM}		–	11	–	A
Charge time	T_a		–	11	–	ns
Discharge time	T_b		–	8.5	–	ns

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

TYPICAL CHARACTERISTICS

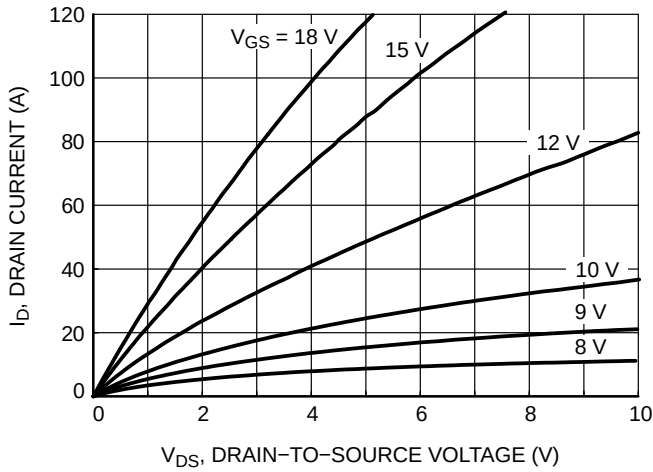


Figure 1. On-Region Characteristics

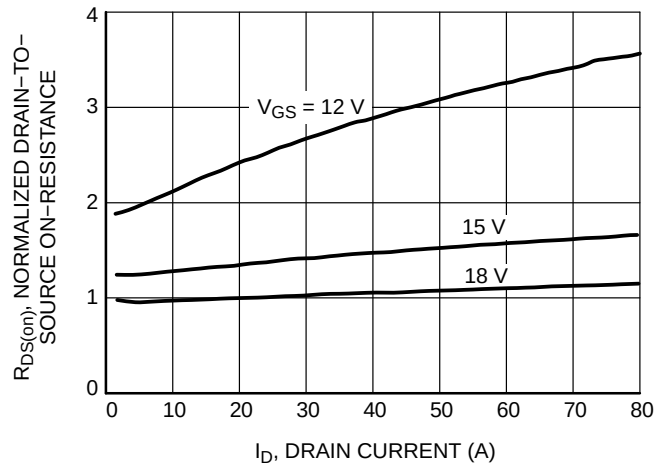


Figure 2. Normalized On-Resistance vs. Drain Current and Gate Voltage

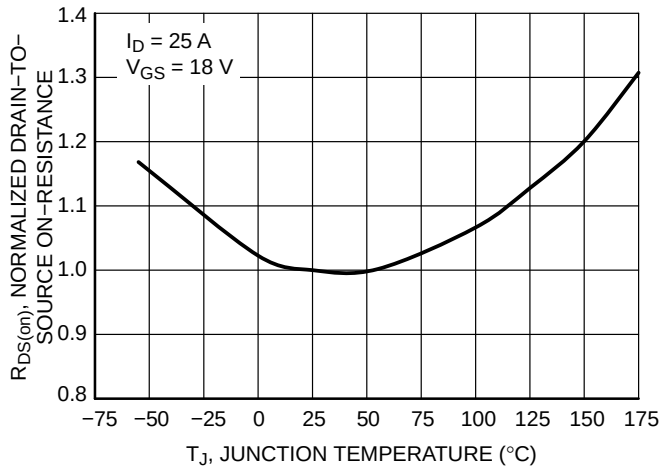


Figure 3. On-Resistance Variation with Temperature

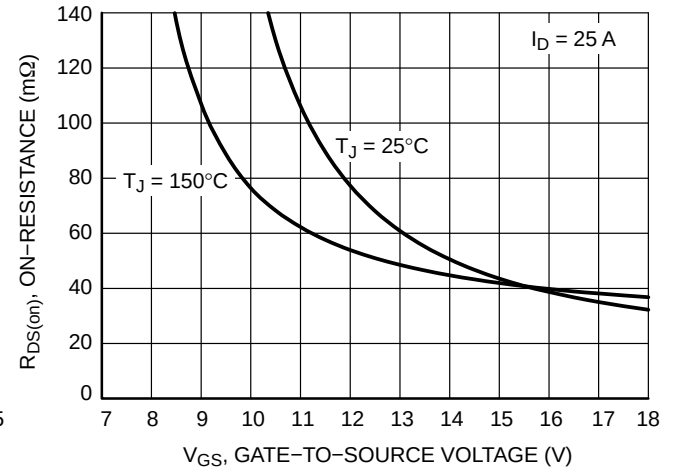


Figure 4. On-Resistance vs. Gate-to-Source Voltage

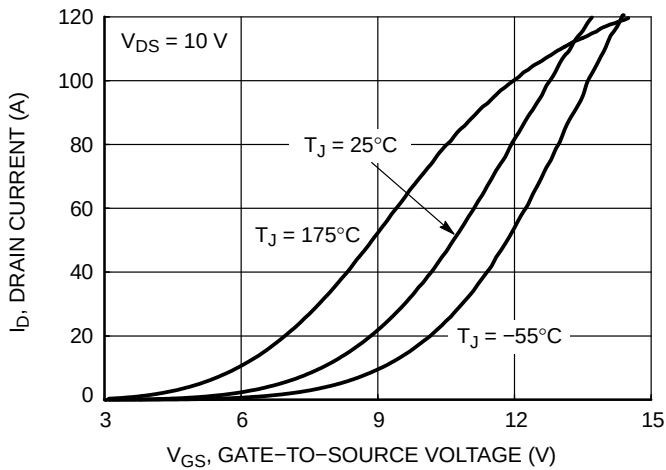


Figure 5. Transfer Characteristics

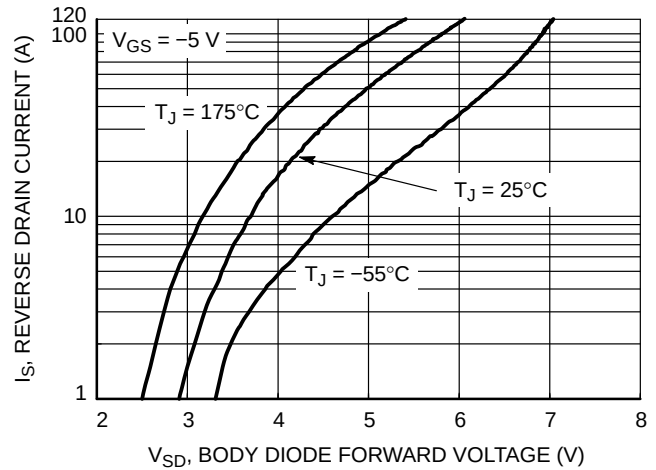


Figure 6. Diode Forward Voltage vs. Current

TYPICAL CHARACTERISTICS (Continued)

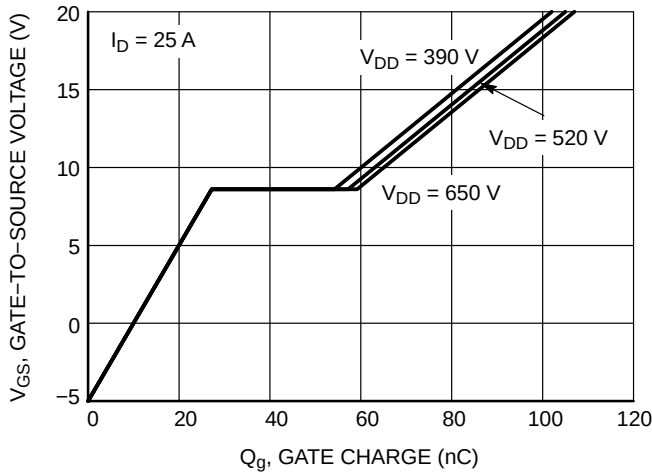


Figure 7. Gate-to-Source Voltage vs. Total Charge

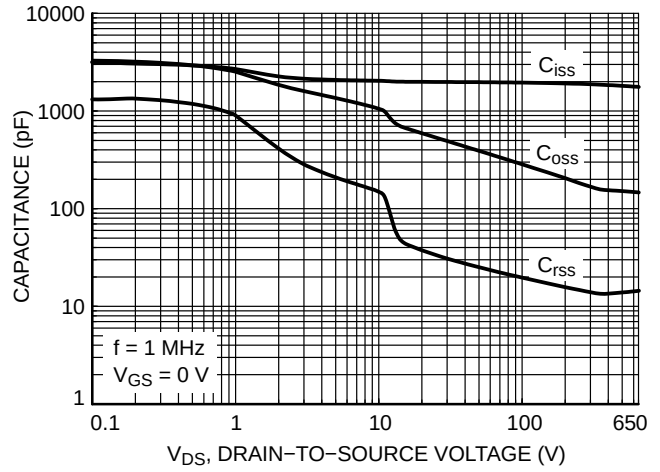


Figure 8. Capacitance vs. Drain-to-Source Voltage

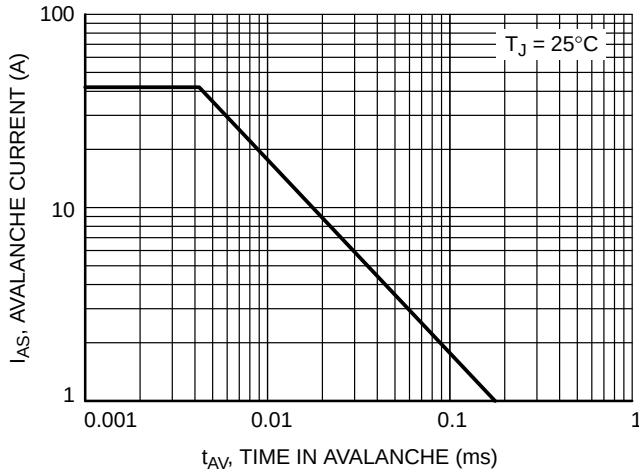


Figure 9. Unclamped Inductive Switching Capability

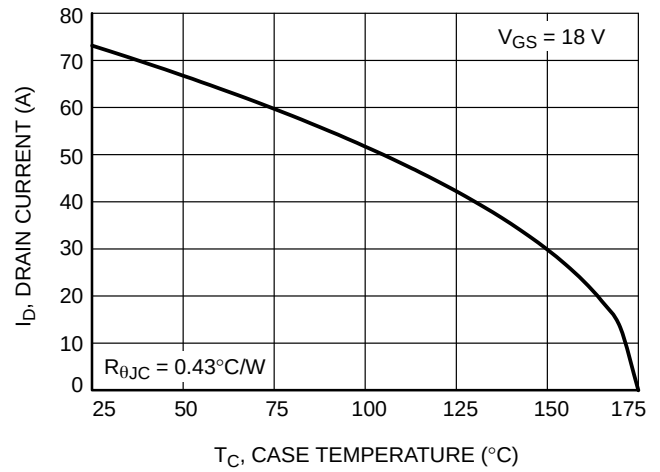


Figure 10. Maximum Continuous Drain Current vs. Case Temperature

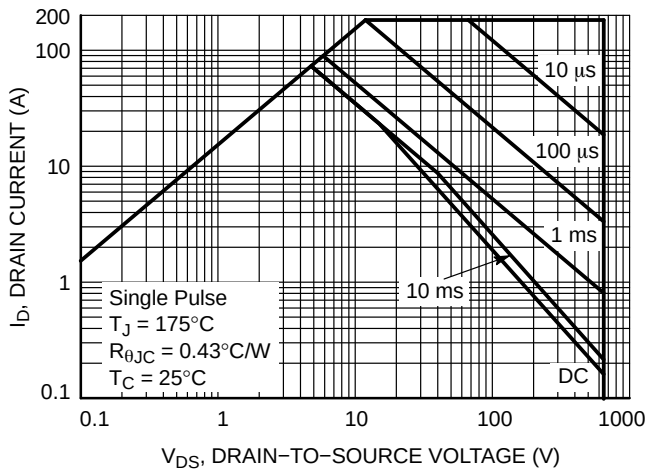


Figure 11. Safe Operating Area

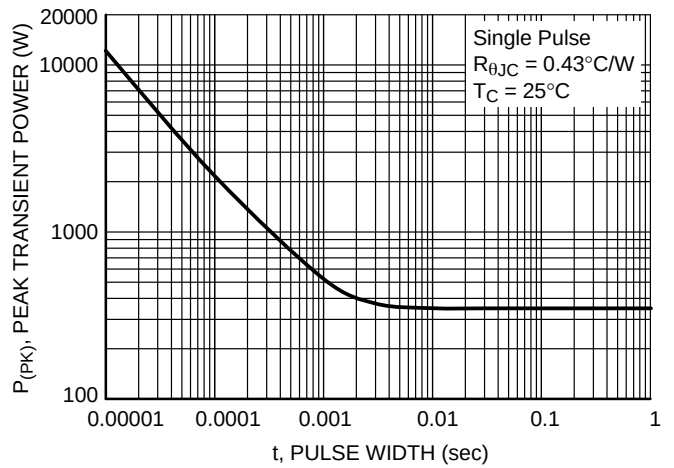


Figure 12. Single Pulse Maximum Power Dissipation

TYPICAL CHARACTERISTICS (Continued)

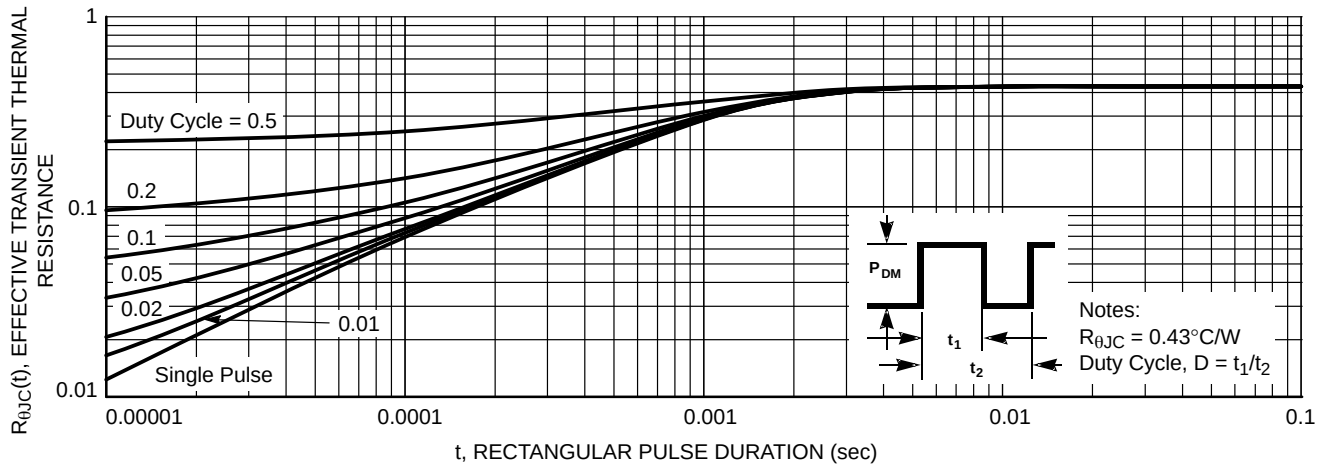
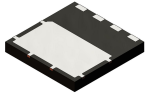
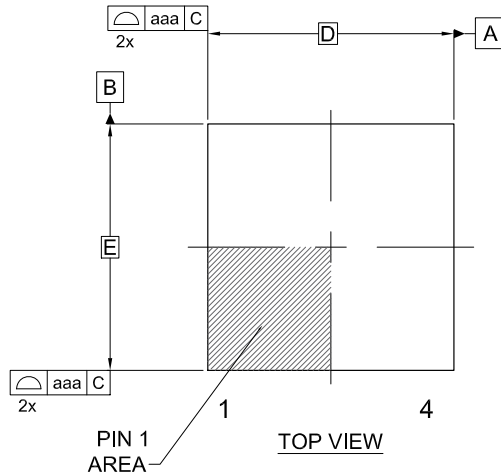


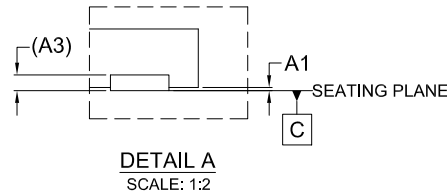
Figure 13. Transient Thermal Impedance


TDFN4 8.00x8.00x1.00, 2.00P
CASE 520AB
ISSUE A

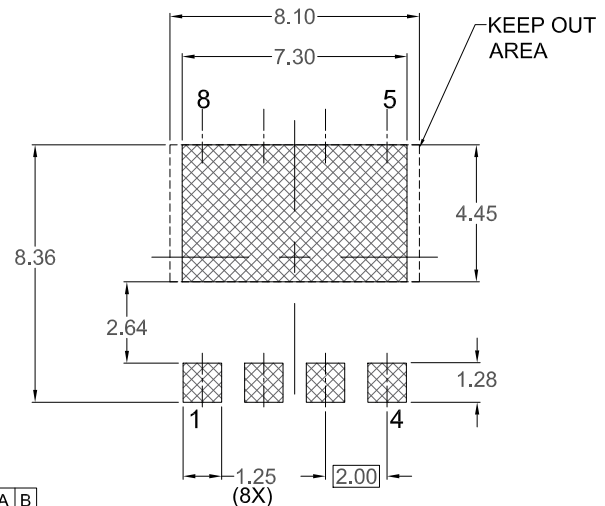
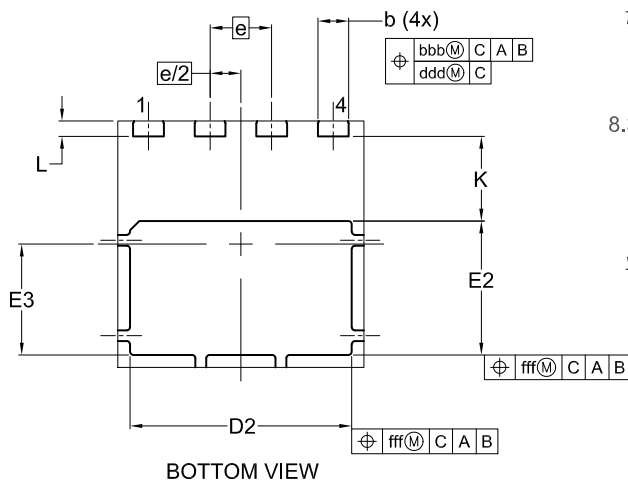
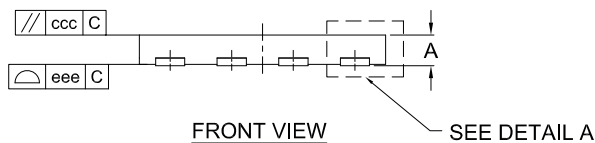
DATE 07 JUN 2024


NOTES:

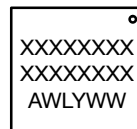
- A) DIMENSIONS AND TOLERANCING CONFIRM TO ASME Y14.5-2018.
B) ALL DIMENSIONS ARE IN MILLIMETERS.
C) DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH. MOLD FLASH OR BURRS DOES NOT EXCEED 0.10MM.
D) IT IS RECOMMENDED TO HAVE NO TRACES OR VIAS WITHIN THE KEEP OUT AREA.



DIM	MILLIMETERS		
	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A1	0.00	---	0.05
A3	0.20 REF		
b	0.90	1.00	1.10
D	8.00 BSC		
D2	7.10	7.20	7.30
E	8.00 BSC		
E2	4.25	4.35	4.45
E3	3.50	3.60	3.70
e	2.00 BSC		
e/2	1.00 BSC		
K	2.65	---	---
L	0.40	0.50	0.60
aaa	0.10		
bbb	0.10		
ccc	0.05		
ddd	0.05		
eee	0.10		
fff	0.10		


RECOMMENDED LAND PATTERN

*FOR ADDITIONAL INFORMATION ON OUR PB-FREE STRATEGY AND SOLDERING DETAILS, PLEASE DOWNLOAD THE ONSEMI SOLDERING AND MOUNTING TECHNIQUES REFERENCE MANUAL, SOLDERRM/D.

GENERIC MARKING DIAGRAM*


XXXX = Specific Device Code

A = Assembly Location

L = Wafer Lot

Y = Year

W = Work Week

▪ = Pb-Free Package

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

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