

## 40V N-ch Power MOSFET

### General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 3.0m\Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

$BV_{DSS}$	$R_{DS(ON),max.}$	$I_D^{[2]}$
40V	4.0m $\Omega$	142A

### Applications

- High efficiency DC/DC Converters
- Synchronous Rectification
- UPS Inverter

### Ordering Information

Part Number	Package	Marking
MXP4004SG	PPAK 5*6	MXP4004SG

### Absolute Maximum Ratings

 $T_C=25^\circ C$  unless otherwise specified

Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-to-Source Voltage <sup>[1]</sup>	40	V
$V_{GSS}$	Gate-to-Source Voltage	$\pm 20$	
$I_D$	Continuous Drain Current <sup>[2]</sup>	142	A
	Continuous Drain Current <sup>[3]</sup>	130	
	Continuous Drain Current at $T_C=100^\circ C$ <sup>[2]</sup>	101	
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10V$ <sup>[2,4]</sup>	569	
$E_{AS}$	Single Pulse Avalanche Energy ( $V_{DD}=30V$ , $V_{GS}=10V$ , $R_G=25\Omega$ , $L=1mH$ )	215	mJ
$P_D$	Power Dissipation	149	W
	Derating Factor above $25^\circ C$	1.0	W/ $^\circ C$
$T_L$	Soldering Temperature	300	$^\circ C$
	Distance of 1.6mm from case for 10 seconds		
$T_J$ & $T_{STG}$	Operating and Storage Temperature Range	-55 to 175	

Caution: Stresses greater than those listed in the "Absolute Maximum Ratings" may cause permanent damage to the device.

### Thermal Characteristics

Symbol	Parameter	Min.	Typ.	Max.	Unit
$R_{\theta JC}$	Thermal Resistance, Junction-to-Case			1.00	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			75	

## Electrical Characteristics

### OFF Characteristics

 $T_J = 25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$BV_{DSS}$	Drain-to-Source Breakdown Voltage	40			V	$V_{GS}=0V, I_D=250\mu A$
$I_{DSS}$	Drain-to-Source Leakage Current			1	$\mu A$	$V_{DS}=32V, V_{GS}=0V$
$I_{GSS}$	Gate-to-Source Leakage Current			$\pm 100$	nA	$V_{GS}=\pm 20V, V_{DS}=0V$

### ON Characteristics

 $T_J = 25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{DS(ON)}$	Static Drain-to-Source On-Resistance	--	3.0	4.0	m $\Omega$	$V_{GS}=10V, I_D=130A^{[5]}$
$V_{GS(TH)}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{DS} = V_{GS}, I_D=250\mu A$

### Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$C_{iss}$	Input Capacitance		3.42		nF	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$
$C_{rSS}$	Reverse Transfer Capacitance		0.16			
$C_{oss}$	Output Capacitance		0.47			
$R_g$	Gate Series Resistance		2.55		$\Omega$	$f=1.0MHz$
$Q_g$	Total Gate Charge		57		nC	$V_{DD}=20V, I_D=130A, V_{GS}=10V$
$Q_{gs}$	Gate-to-Source Charge		20			
$Q_{gd}$	Gate-to-Drain (Miller) Charge		15			

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on Delay Time		739		ns	$V_{DD}=20V, I_D=130A, V_{GS}=10V, R_G=2.5\Omega$
$t_{rise}$	Rise Time		19			
$t_{d(off)}$	Turn-off Delay Time		205			
$t_{fall}$	Fall Time		14			

### Source-Drain Body Diode Characteristics

 $T_J = 25^\circ\text{C}$  unless otherwise specified

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$I_{SD}$	Continuous Source Current <sup>[2]</sup>			142	A	Maximum Ratings
$V_{SD}$	Diode Forward Voltage		1.0	1.2	V	$I_S=130A, V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time		31		ns	$V_{GS}=0V, I_F=20A, di/dt=100A/\mu s$
$Q_{rr}$	Reverse Recovery Charge		32		nC	

Note:

 [1]  $T_J = +25^\circ\text{C}$  to  $+175^\circ\text{C}$ 

[2] Silicon limited current only

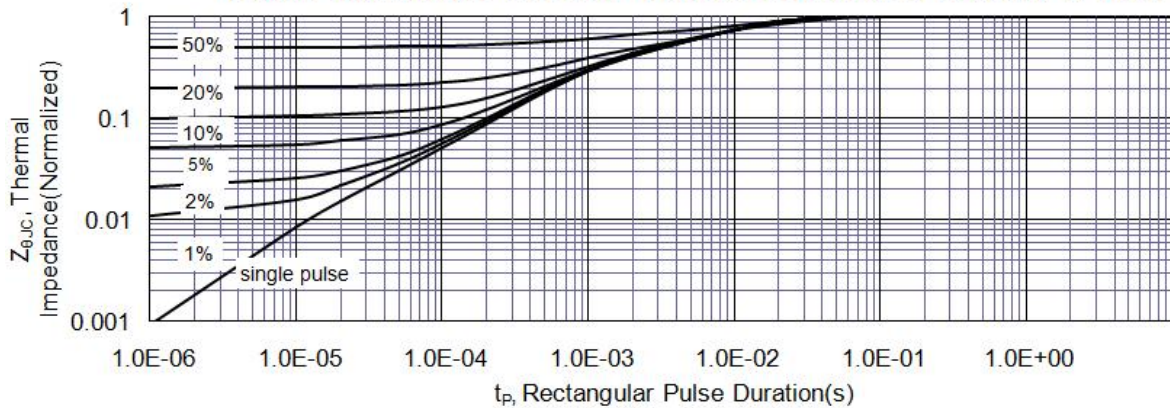
[3] Package limited current

[4] Repetitive rating, pulse width limited by both maximum junction temperature.

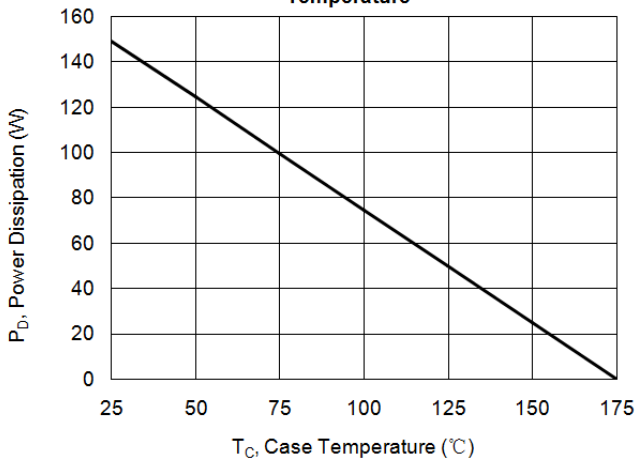
 [5] Pulse width  $\leq 380\mu s$ ; duty cycle  $\leq 2\%$ .

**Typical Characteristics**

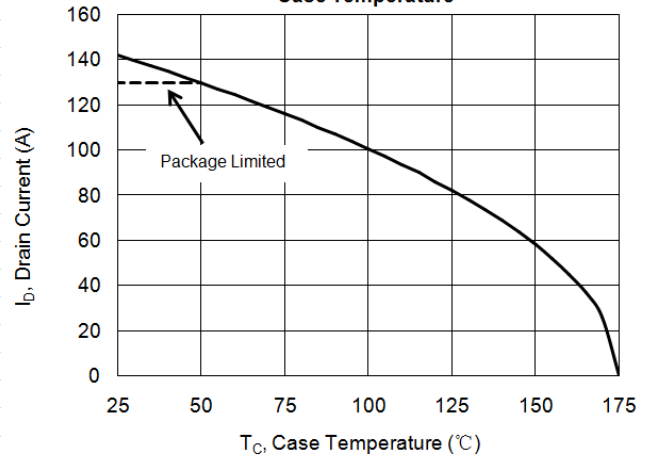
**Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case**



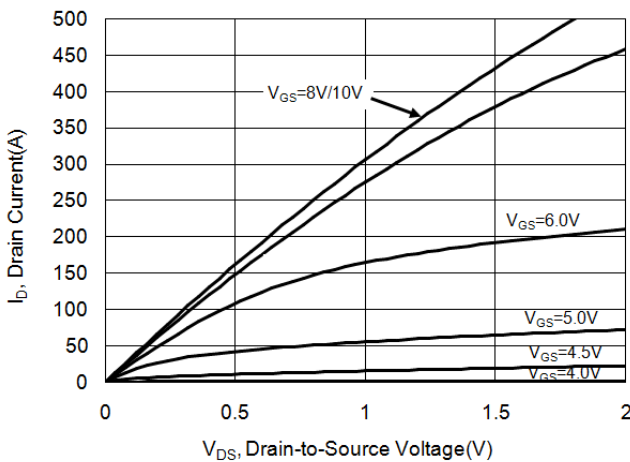
**Figure 2. Maximum Power Dissipation vs. Case Temperature**



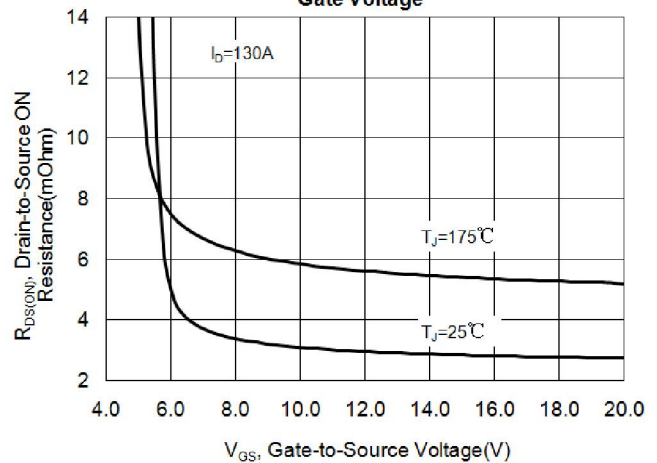
**Figure 3. Maximum Continuous Drain Current vs. Case Temperature**



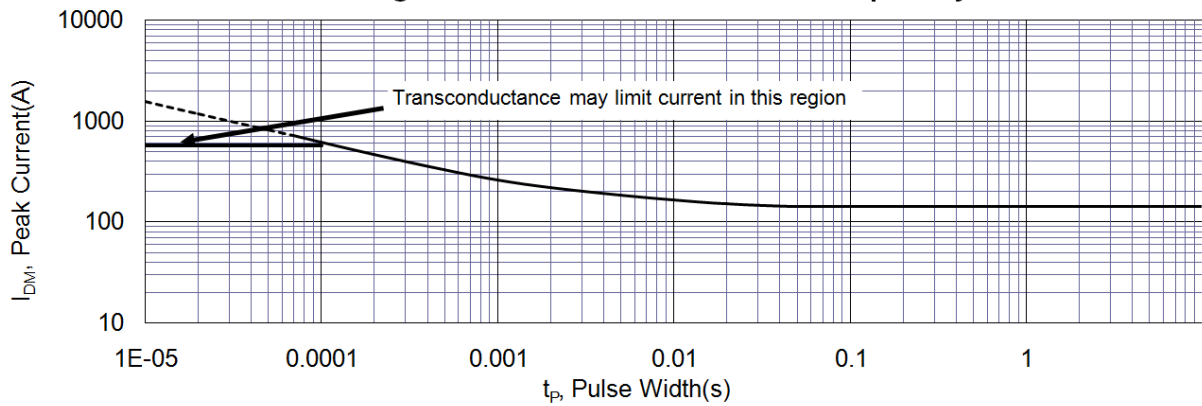
**Figure 4. Typical Output Characteristics**



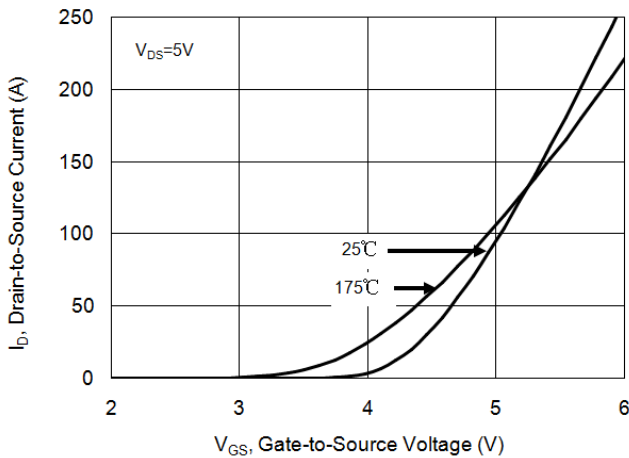
**Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage**



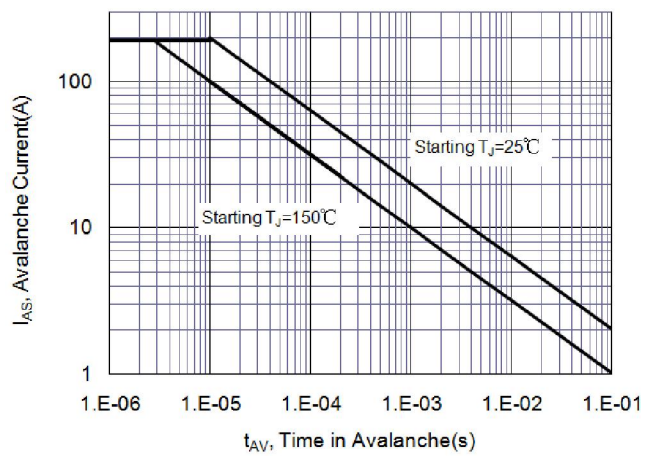
**Figure 6. Maximum Peak Current Capability**



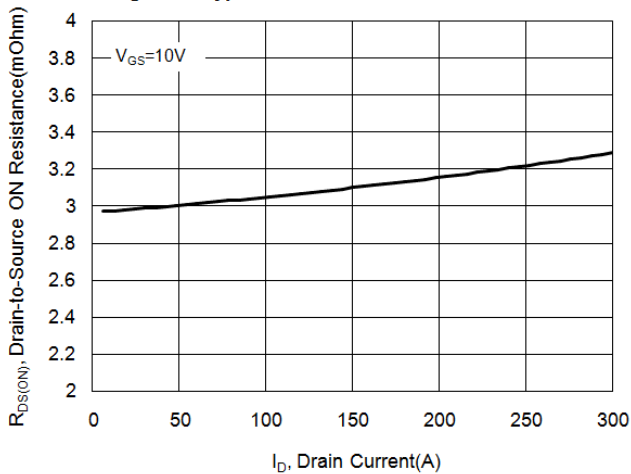
**Figure 7. Typical Transfer Characteristics**



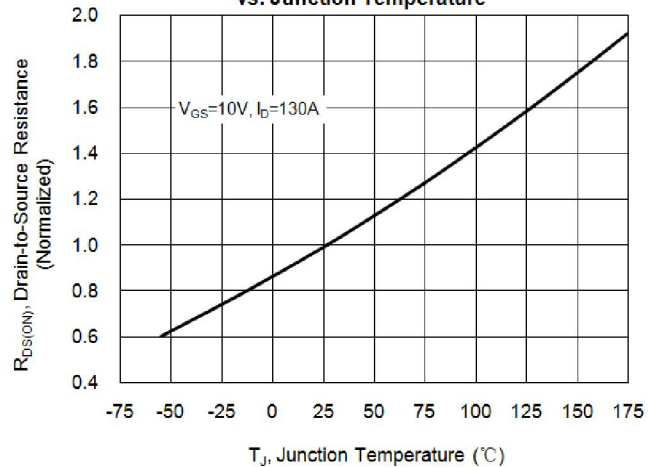
**Figure 8. Unclamped Inductive Switching Capability**



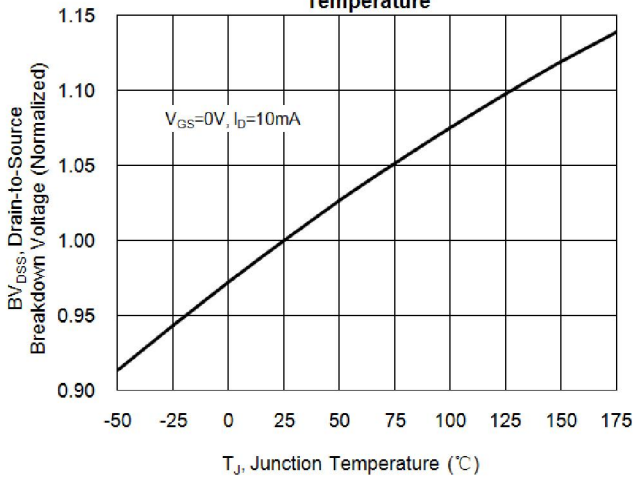
**Figure 9. Typical Drain-to-Source ON Resistance**



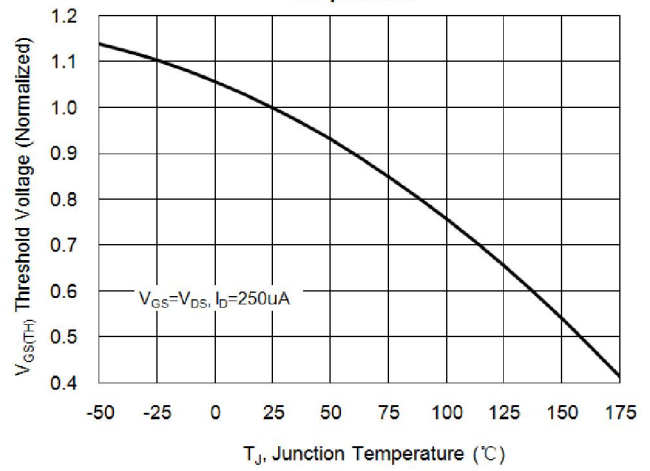
**Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature**



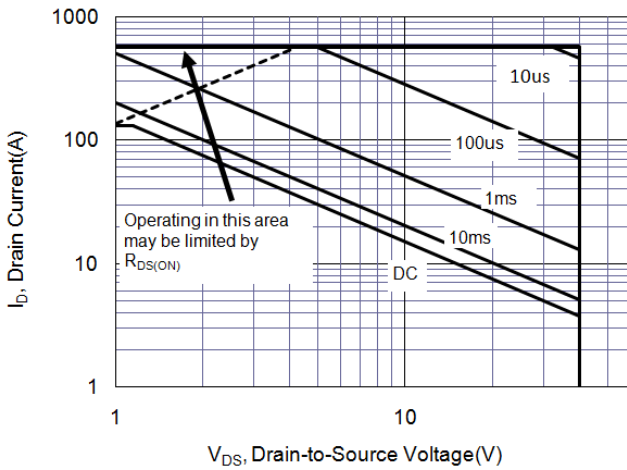
**Figure 11. Typical Breakdown Voltage vs. Junction Temperature**



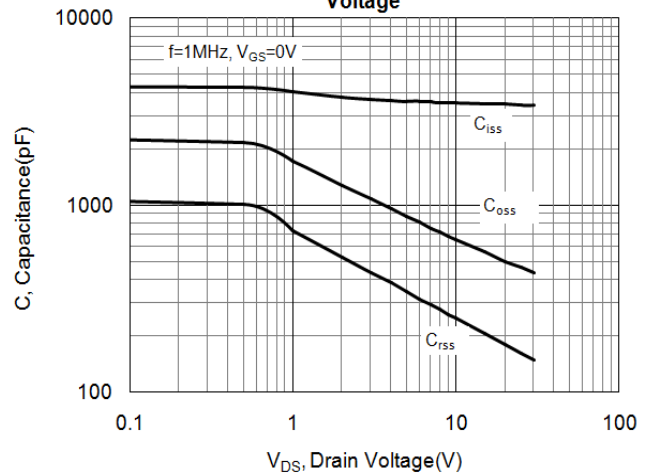
**Figure 12. Typical Threshold Voltage vs. Junction Temperature**



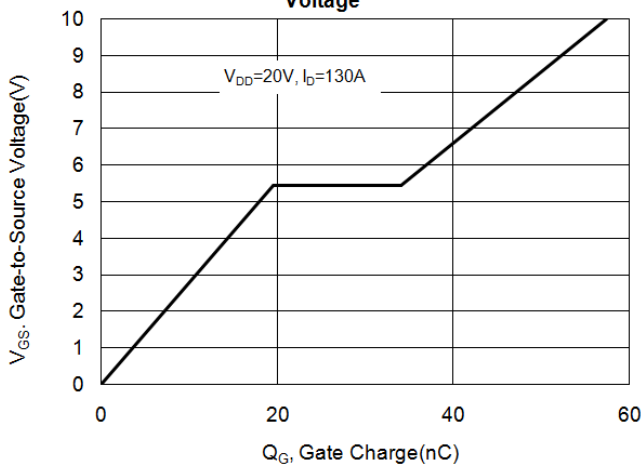
**Figure 13. Maximum Forward Safe Operation Area**



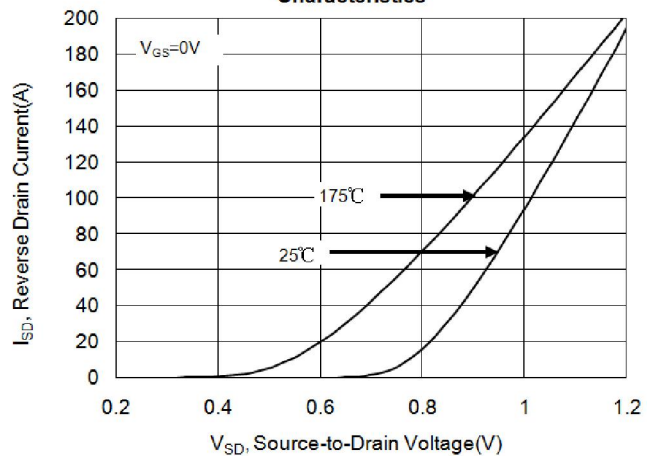
**Figure 14. Typical Capacitance vs. Drain-to-Source Voltage**



**Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage**



**Figure 16. Typical Body Diode Transfer Characteristics**



**Disclaimers:**

MaxPower Semiconductor Inc. (MXP) reserves the right to make changes without notice in order to improve reliability, function or design and to discontinue any product or service without notice. Customers should obtain the latest relevant information before orders and should verify that such information is current and complete. All products are sold subject to MXP's terms and conditions supplied at the time of order acknowledgement.

MaxPower Semiconductor Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf, disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

MaxPower Semiconductor Inc. disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify MXP's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

MaxPower Semiconductor Inc. warrants performance of its hardware products to the specifications at the time of sale, testing, reliability and quality control are used to the extent MXP deems necessary to support this warrantee. Except where agreed upon by contractual agreement, testing of all parameters of each product is not necessarily performed.

MaxPower Semiconductor Inc. does not assume any liability arising from the use of any product or circuit designs described herein. Customers are responsible for their products and applications using MXP's components. To minimize risk, customers must provide adequate design and operating safeguards.

MaxPower Semiconductor Inc. does not warrant or convey any license to any intellectual property rights either expressed or implied under its patent rights, nor the rights of others. Reproduction of information in MXP's data sheets or data books is permissible only if reproduction is without modification or alteration. Reproduction of this information with any alteration is an unfair and deceptive business practice.

MaxPower Semiconductor Inc. is not responsible or liable for such altered documentation. Resale of MXP's products with statements different from or beyond the parameters stated by MaxPower Semiconductor Inc. for that product or service voids all express or implied warranties for the associated MXP product or service and is an unfair and deceptive business practice.

MaxPower Semiconductor Inc. is not responsible or liable for any such statements.

Published by MaxPower Semiconductor Inc.  
181 Metro Dr, Suite 590, San Jose, CA 95110

All Rights Reserved.