

## 40V N-ch Power MOSFET

### General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 1.7m\Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

$BV_{DSS}$	$R_{DS(ON),max.}$	$I_D^{[2]}$
40V	2.0m $\Omega$	262A

### Applications

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

### Ordering Information

Part Number	Package	Marking
MXP4002AF	TO-263	MXP4002AF

### Absolute Maximum Ratings

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

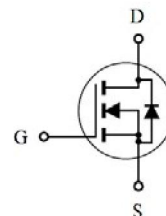
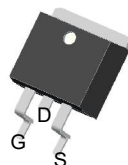
Symbol	Parameter	Value	Unit
$V_{DSS}$	Drain-to-Source Voltage <sup>[1]</sup>	40	V
$V_{GSS}$	Gate-to-Source Voltage	$\pm 20$	
$I_D$	Continuous Drain Current <sup>[2]</sup>	262	A
	Continuous Drain Current <sup>[3]</sup>	192	
	Continuous Drain Current at $T_C=100^{\circ}C$ <sup>[2]</sup>	185	
$I_{DM}$	Pulsed Drain Current at $V_{GS}=10V$ <sup>[2,4]</sup>	1064	
$E_{AS}$	Single Pulse Avalanche Energy ( $V_{DD}=30V$ , $V_{GS}=10V$ , $R_G=25\Omega$ , $L=1mH$ )	528	mJ
$P_D$	Power Dissipation	253	W
	Derating Factor above $25^{\circ}C$	1.7	W/ $^{\circ}C$
$T_L$	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	$^{\circ}C$
$T_J$ & $T_{STG}$	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			0.59	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			62	

TO-263-2L



## 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	--	1.7	2.0	m $\Omega$	$V_{GS}=10V$ , $I_D=192A^{[5]}$
			2.1	2.7	m $\Omega$	$V_{GS}=4.5V$ , $I_D=96A^{[5]}$
$V_{GS(TH)}$	Gate Threshold Voltage	1.0	--	3.0	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		7.3		nF	$V_{GS}=0V$ , $V_{DS}=25V$ , $f=1.0MHz$
$C_{rss}$	Reverse Transfer Capacitance		0.3			
$C_{oss}$	Output Capacitance		1.2			
$R_g$	Gate Series Resistance		2.6		$\Omega$	$f=1.0MHz$
$Q_g$	Total Gate Charge		135		nC	$V_{DD}=20V$ , $I_D=120A$ , $V_{GS}=10V$
$Q_{gs}$	Gate-to-Source Charge		23			
$Q_{gd}$	Gate-to-Drain (Miller) Charge		33			

### Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on Delay Time		15		ns	$V_{DD}=20V$ $I_D=120A$ $V_{GS}=10V$ $R_G=2.5\Omega$
$t_{rise}$	Rise Time		23			
$t_{d(off)}$	Turn-off Delay Time		104			
$t_{fall}$	Fall Time		24			

### 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>			262	A	Maximum Ratings
$V_{SD}$	Diode Forward Voltage		0.9	1.2	V	$I_S=120A$ , $V_{GS}=0V$
$t_{rr}$	Reverse Recovery Time		58		ns	$V_{GS}=0V$ $I_F=20A$ , $di/dt=100A/\mu s$
$Q_{rr}$	Reverse Recovery Charge		77		nC	

Note:

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

[2] Silicon limited current only

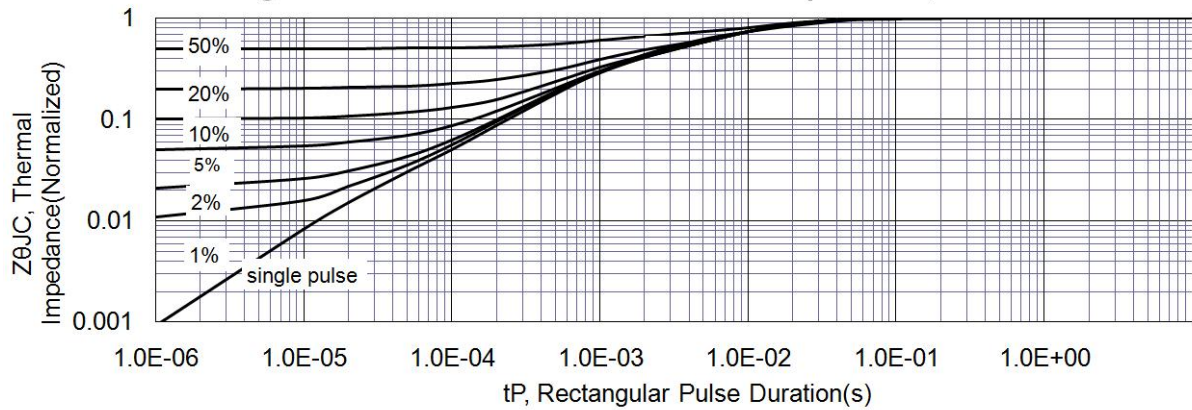
[3] Package limited current

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

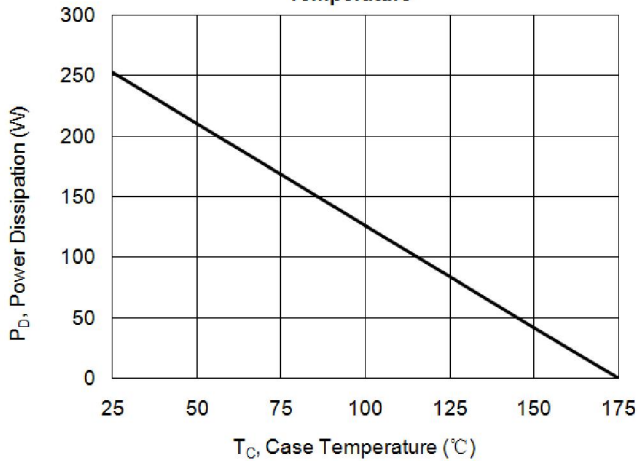
[5] Pulse width  $\leq 380\mu s$ ; duty cycle  $\leq 2\%$ .

## Typical Characteristics

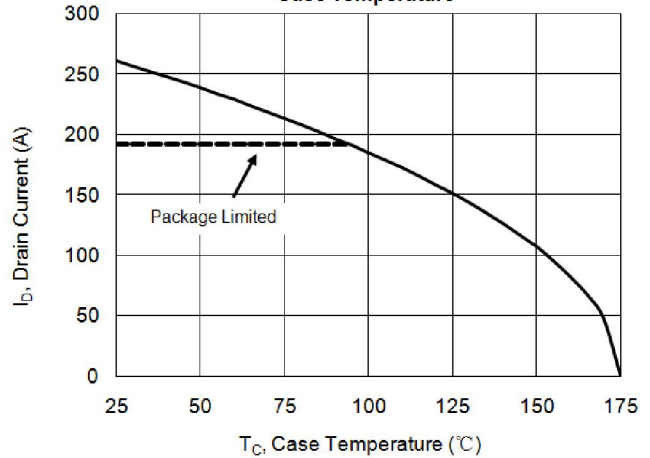
**Figure 1. Maximum Effective Thermal Impedance, Junction-to-Case**



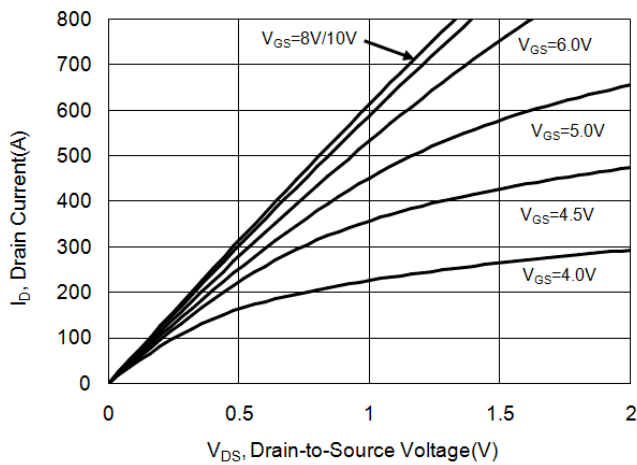
**Figure 2. Maximum Power Dissipation vs. Case Temperature**



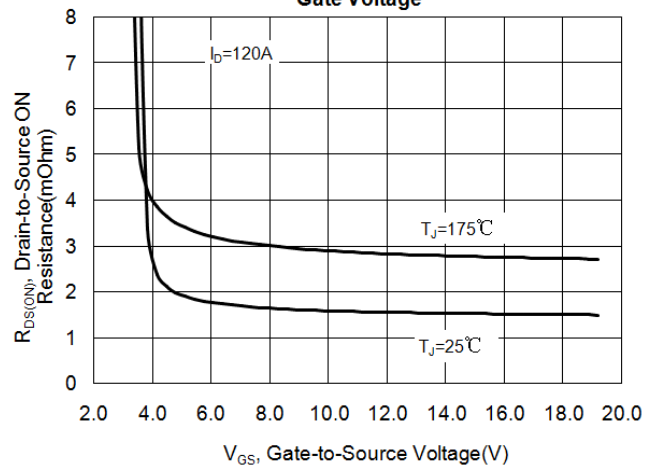
**Figure 3. Maximum Continuous Drain Current vs Case Temperature**



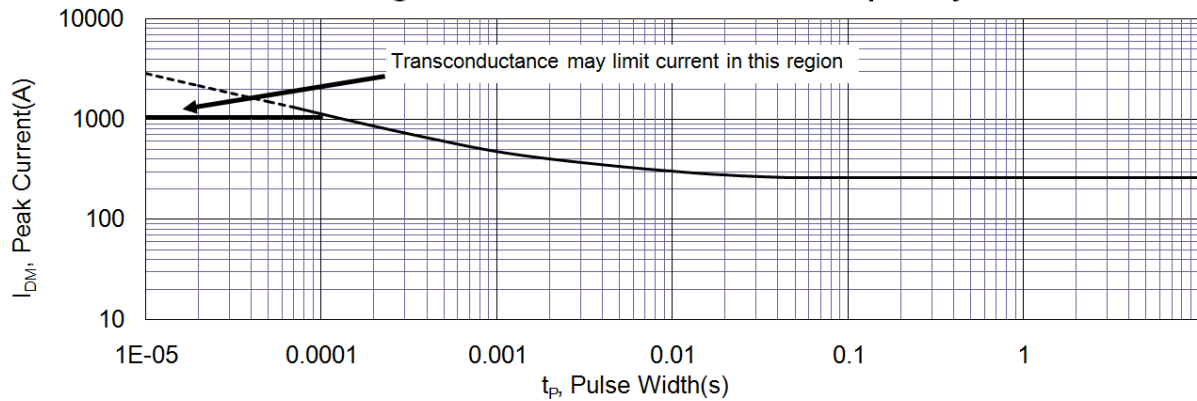
**Figure 4. Typical Output Characteristics**



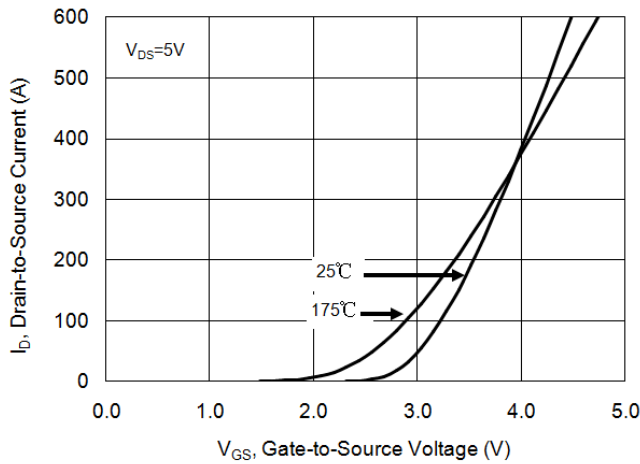
**Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage**



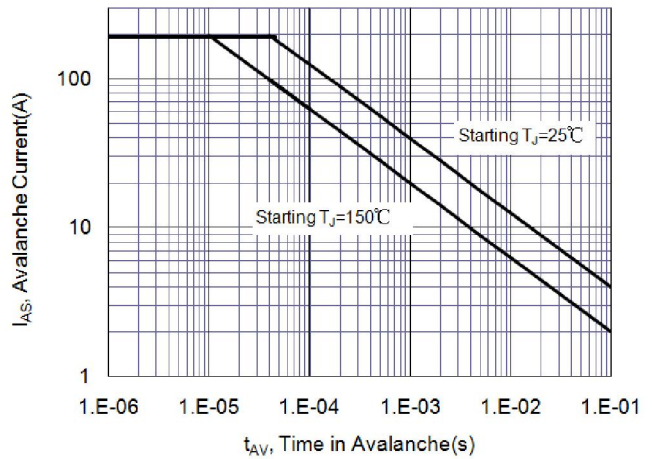
**Figure 6. Maximum Peak Current Capability**



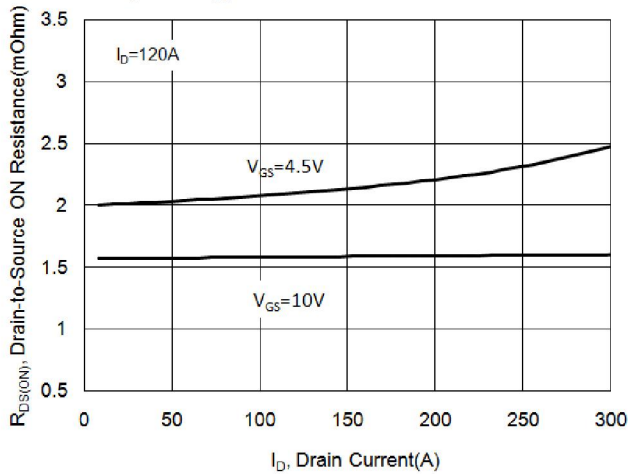
**Figure 7. Typical Transfer Characteristics**



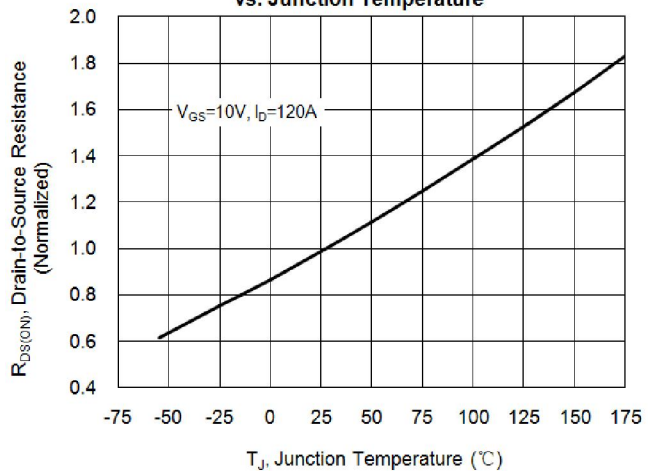
**Figure 8. Unclamped Inductive Switching Capability**



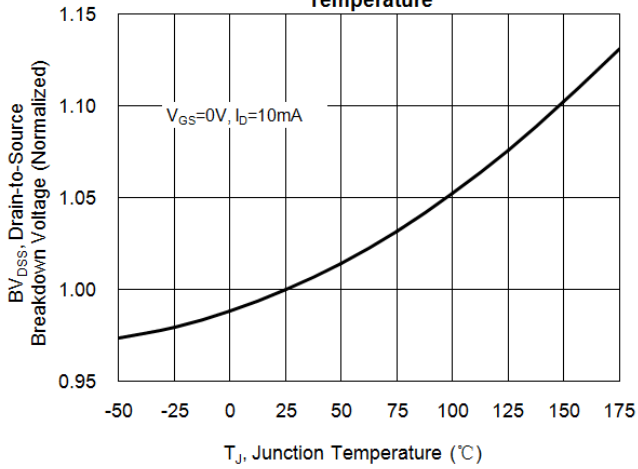
**Figure 9. Typical Drain-to-Source ON Resistance**



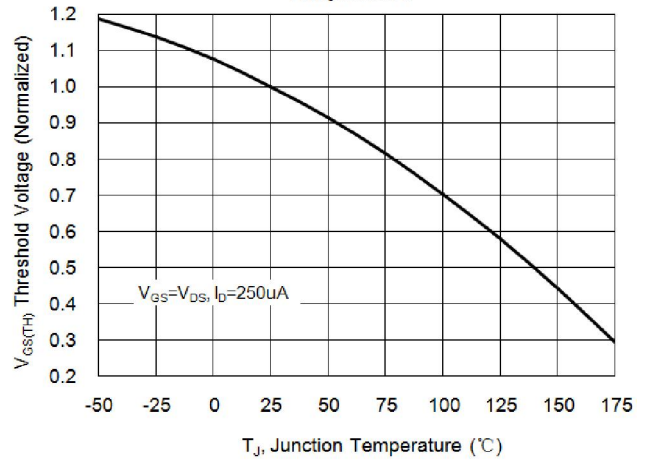
**Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature**



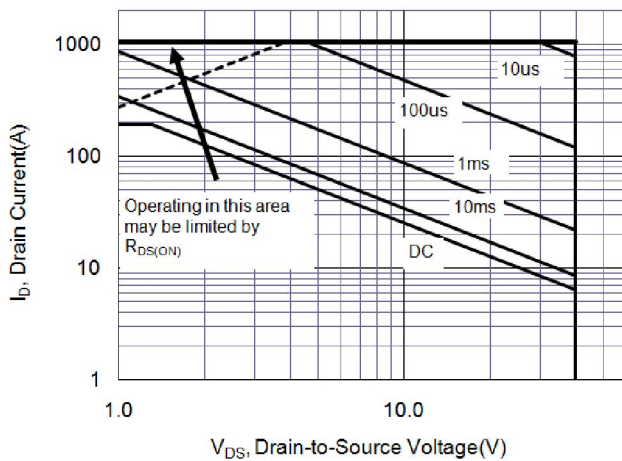
**Figure 11. Typical Breakdown Voltage vs. Junction Temperature**



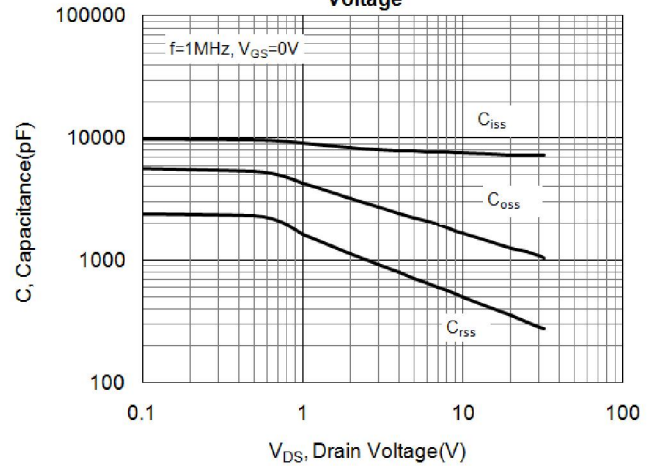
**Figure 12. Typical Threshold Voltage vs. Junction Temperature**



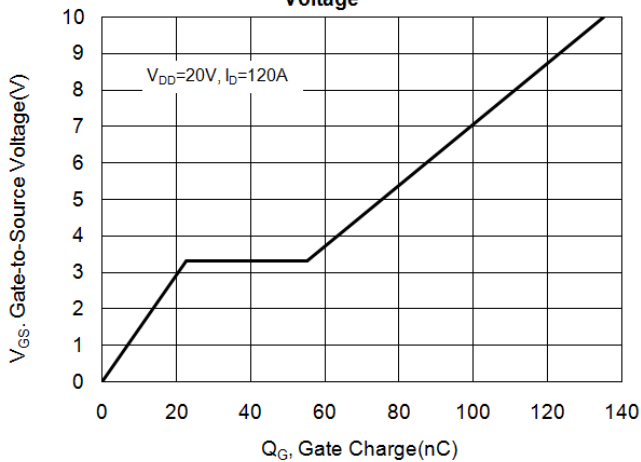
**Figure 13. Maximum Forward Safe Operation Area**



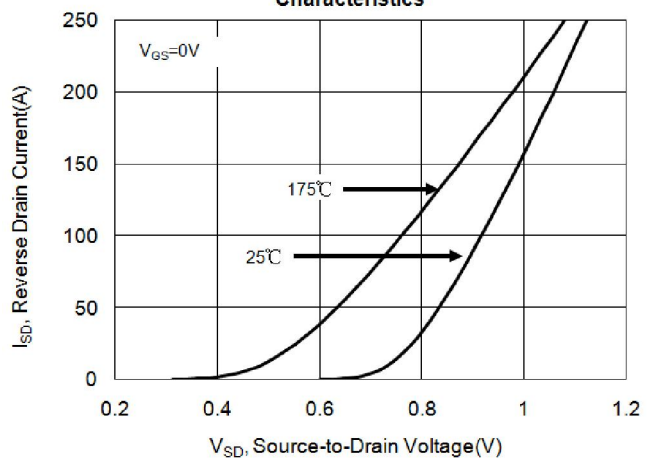
**Figure 14. Typical Capacitance vs. Drain-to-Source Voltage**



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



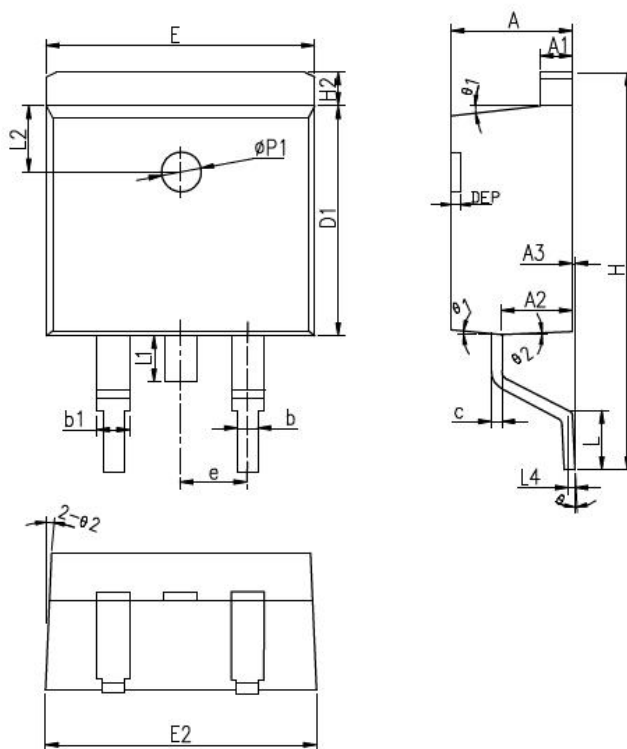
**Figure 16. Typical Body Diode Transfer Characteristics**



## Package

### Dimensions

#### TO-263-2L



COMMON DIMENSIONS

SYMBOL	MM			INCH		
	MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185
A1	1.22	1.27	1.32	0.048	0.050	0.052
A2	2.59	2.69	2.79	0.102	0.106	0.110
A3	0.00	0.10	0.20	0.000	0.004	0.008
b	0.77	0.813	0.90	0.030	0.032	0.035
b1	1.20	1.270	1.36	0.047	0.050	0.054
c	0.34	0.381	0.47	0.013	0.015	0.019
D1	8.60	8.70	8.80	0.339	0.343	0.346
E	10.00	10.16	10.26	0.394	0.400	0.404
E2	10.00	10.10	10.20	0.394	0.398	0.402
e	2.54 BSC			0.100 BSC		
H	14.70	15.10	15.50	0.579	0.594	0.610
H2	1.17	1.27	1.40	0.046	0.050	0.055
L	2.00	2.30	2.60	0.079	0.091	0.102
L1	1.45	1.55	1.70	0.057	0.061	0.067
L2	2.50 REF			0.098 REF		
L4	0.25 BSC			0.010 BSC		
$\theta$	0°	5°	8°	0°	5°	8°
$\theta1$	5°	7°	9°	5°	7°	9°
$\theta2$	1°	3°	5°	1°	3°	5°
$\phi P1$	1.40	1.50	1.60	0.055	0.059	0.063
DEP	0.05	0.10	0.20	0.002	0.004	0.008



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