

40V N-ch Power MOSFET, Logic Drive

General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 1.2m\Omega @ V_{GS}=10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

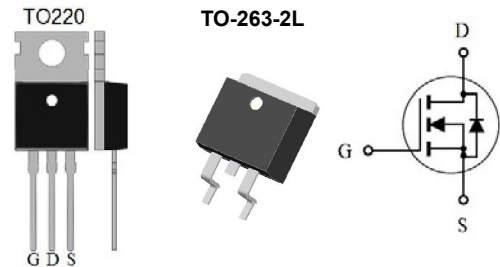
BV_{DSS}	$R_{DS(ON),max.}$	$I_D^{[2]}$
40V	1.5m Ω	379

Applications

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

Ordering Information

Part Number	Package	Marking
MXP40N1P5ATL	TO-220	MXP40N1P5ATL
MXP40N1P5AFL	TO-263-2L	MXP40N1P5AFL



Absolute Maximum Ratings

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

Symbol	Parameter	Value	Unit
V_{DSS}	Drain-to-Source Voltage ^[1]	40	V
V_{GSS}	Gate-to-Source Voltage	± 20	
I_D	Continuous Drain Current ^[2]	379	A
	Continuous Drain Current ^[3]	192	
	Continuous Drain Current at $T_C=100^{\circ}C$ ^[2]	268	
I_{DM}	Pulsed Drain Current at $V_{GS}=10V$ ^[2,4]	1514	
E_{AS}	Single Pulse Avalanche Energy ($V_{DD}=20V, V_{GS}=10V, R_G=25\Omega, L=1mH$)	648	mJ
P_D	Power Dissipation	397	W
	Derating Factor above $25^{\circ}C$	2.6	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			0.38	$^{\circ}C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			61	

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	μA	$V_{DS}=40V, V_{GS}=0V$
I_{GSS}	Gate-to-Source Leakage Current			± 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	--	1.2	1.5	m Ω	$V_{GS}=10V, I_D=192A^{[5]}$
		--	1.7	2.0	m Ω	$V_{GS}=4.5V, I_D=96A^{[5]}$
$V_{GS(TH)}$	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		8.9		nF	$V_{GS}=0V, V_{DS}=25V, f=1.0MHz$
C_{rss}	Reverse Transfer Capacitance		0.4			
C_{oss}	Output Capacitance		1.5			
R_g	Gate Series Resistance		1.7		Ω	$f=1.0MHz$
Q_g	Total Gate Charge		166		nC	$V_{DD}=20V, I_D=120A, V_{GS}=10V$
Q_{gs}	Gate-to-Source Charge		27			
Q_{gd}	Gate-to-Drain (Miller) Charge		39			

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{d(on)}$	Turn-on Delay Time		18		ns	$V_{DD}=20V, I_D=120A, V_{GS}=10V, R_G=2.5\Omega$
t_{rise}	Rise Time		25			
$t_{d(off)}$	Turn-off Delay Time		133			
t_{fall}	Fall Time		26			

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 ^[2]			379	A	Maximum Ratings
V_{SD}	Diode Forward Voltage		0.9	1.2	V	$I_S=120A, V_{GS}=0V$
t_{rr}	Reverse Recovery Time		60		ns	$V_{GS}=0V, I_F=20A, di/dt=100A/\mu s$
Q_{rr}	Reverse Recovery Charge		104		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

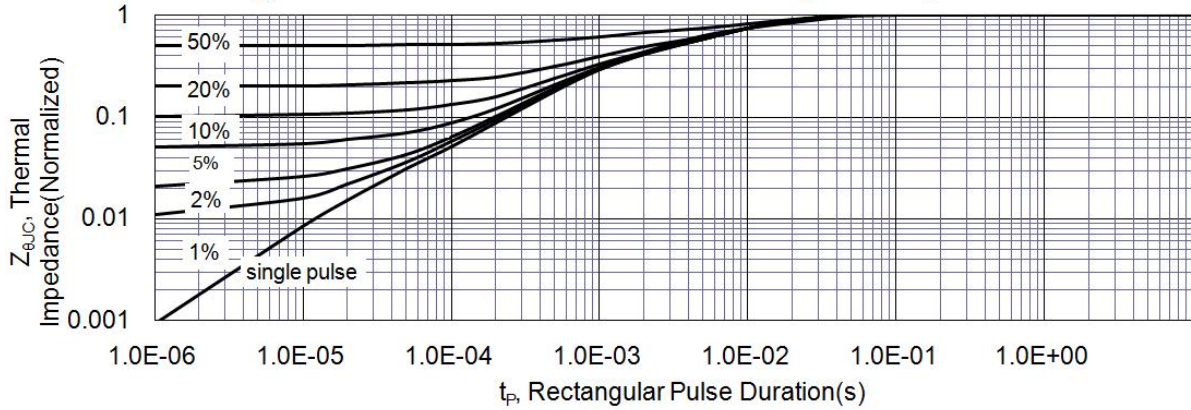


Figure 2. Maximum Power Dissipation vs. Case Temperature

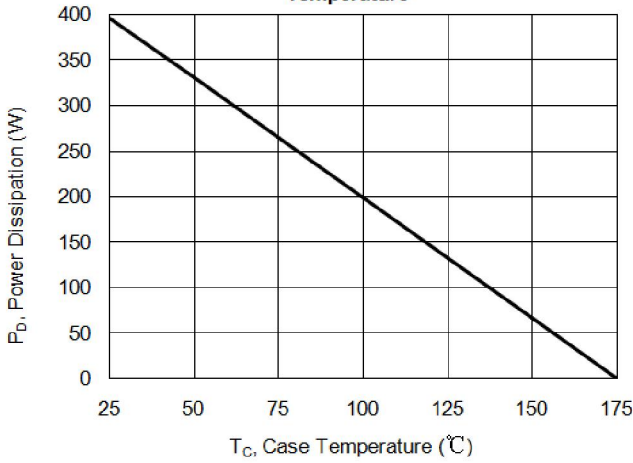


Figure 3. Maximum Continuous Drain Current vs. Case Temperature

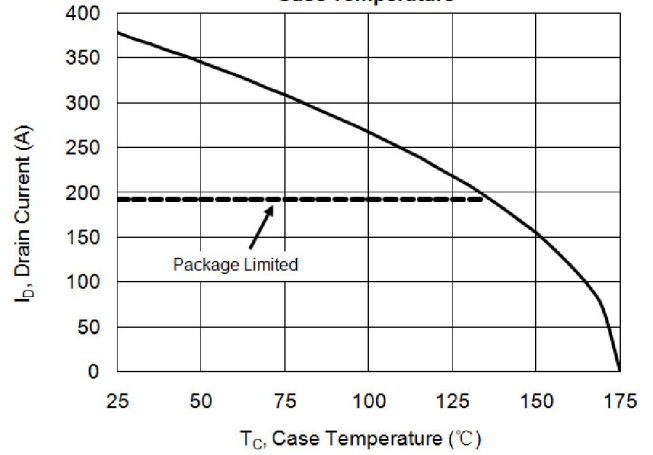


Figure 4. Typical Output Characteristics

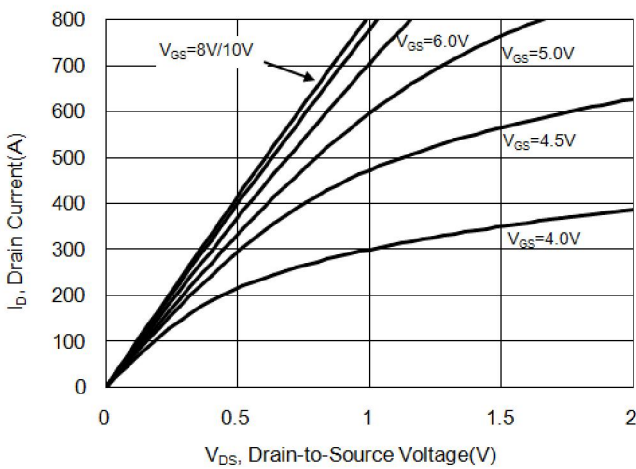


Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage

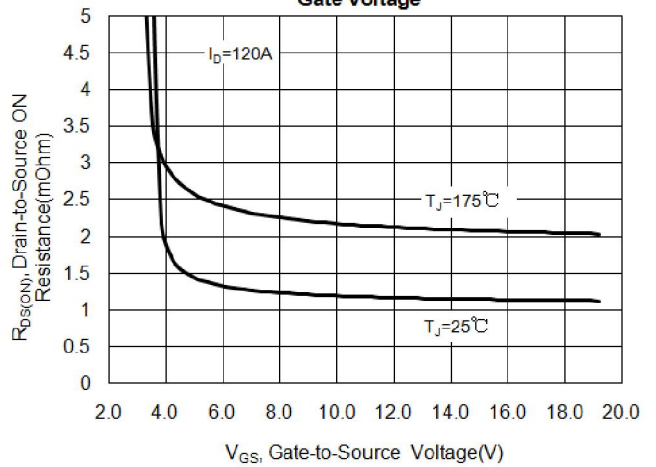


Figure 6. Maximum Peak Current Capability

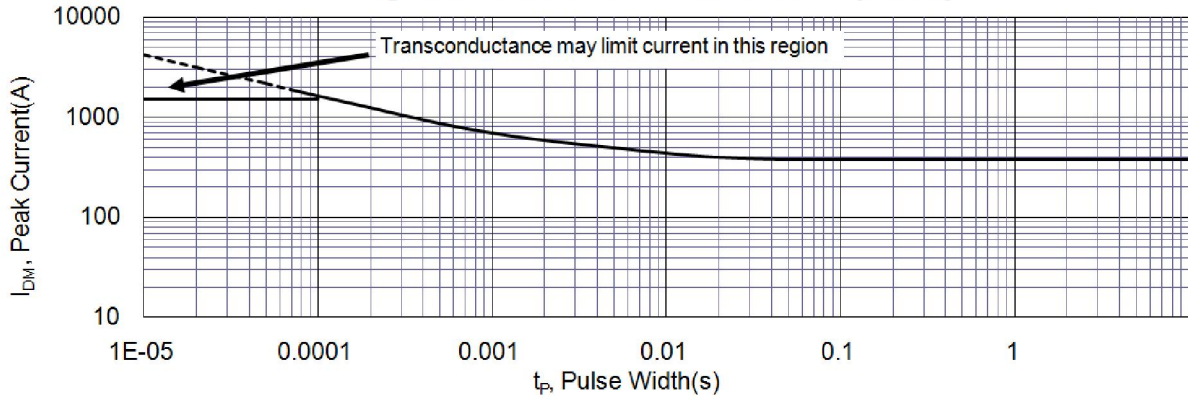


Figure 7. Typical Transfer Characteristics

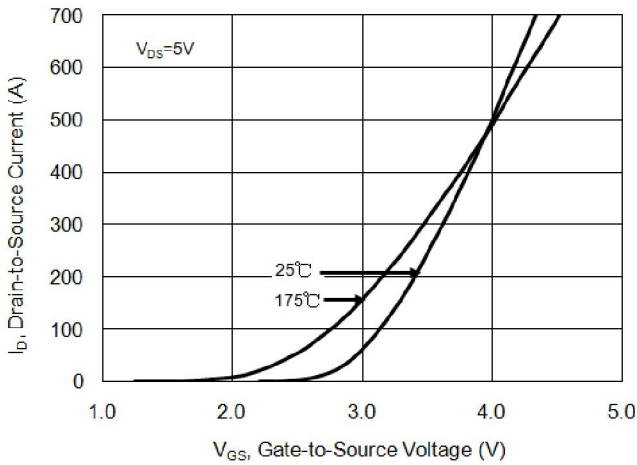


Figure 8. Unclamped Inductive Switching Capability

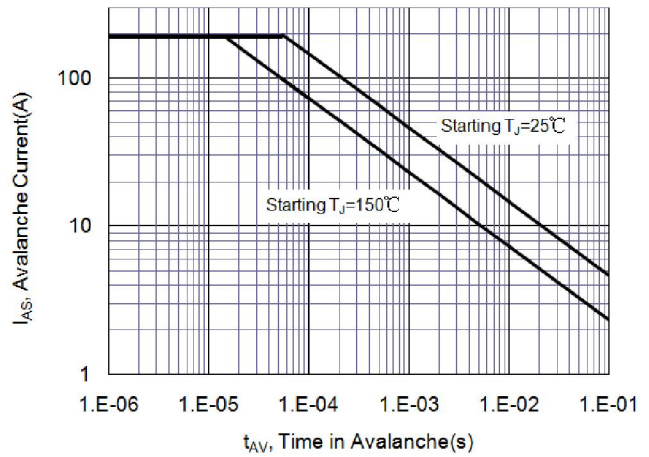


Figure 9. Typical Drain-to-Source ON Resistance

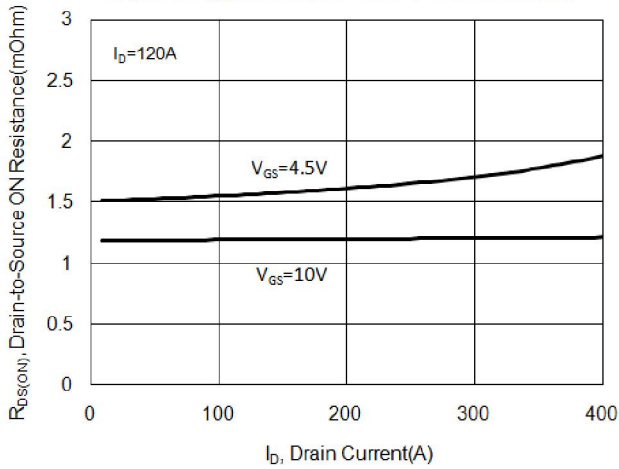


Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature

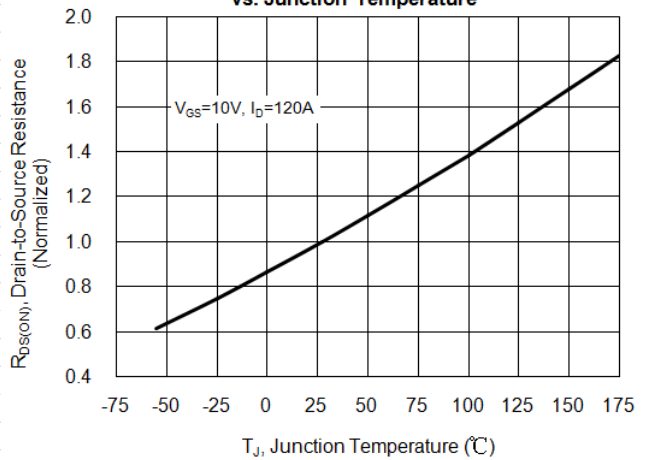


Figure 11. Typical Breakdown Voltage vs. Junction Temperature

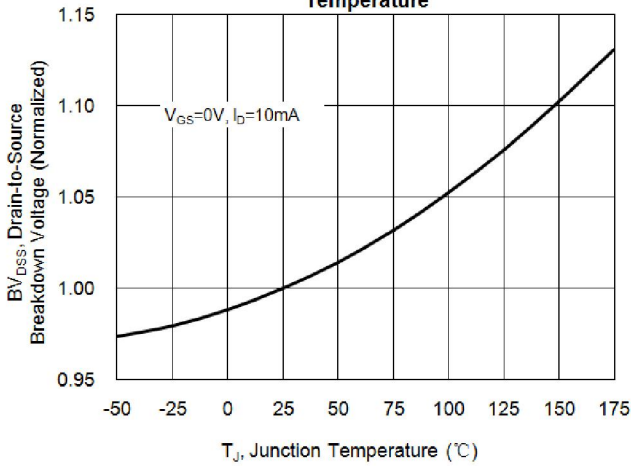


Figure 12. Typical Threshold Voltage vs. Junction Temperature

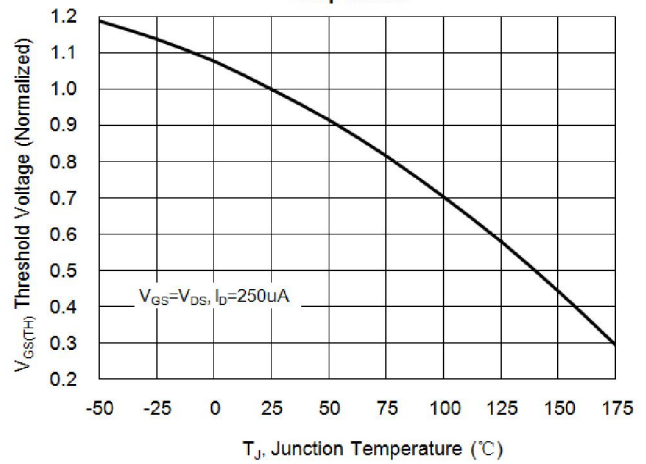


Figure 13. Maximum Forward Safe Operation Area

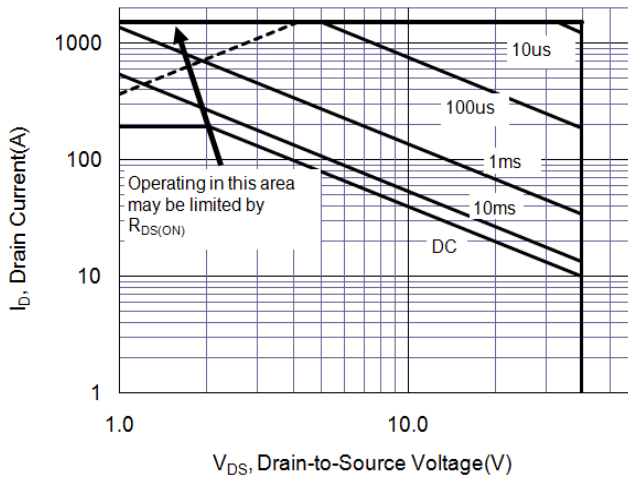


Figure 14. Typical Capacitance vs. Drain-to-Source Voltage

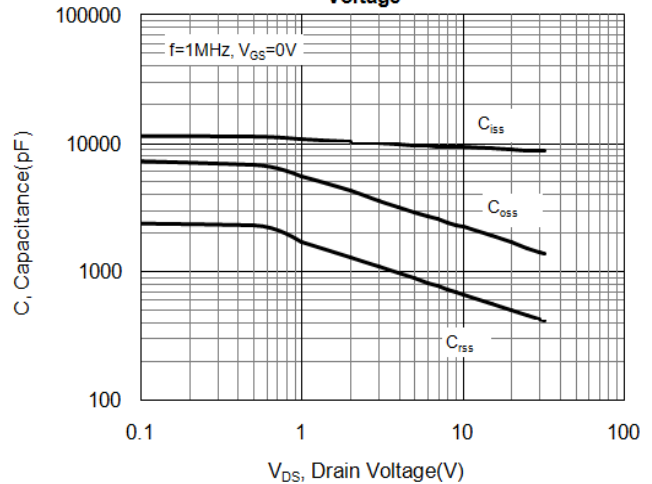


Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage

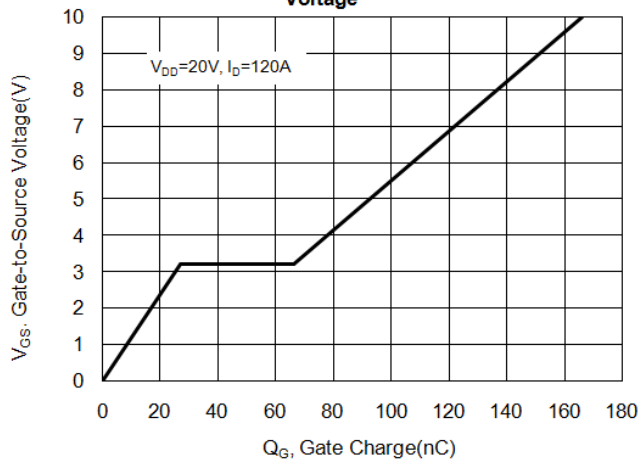
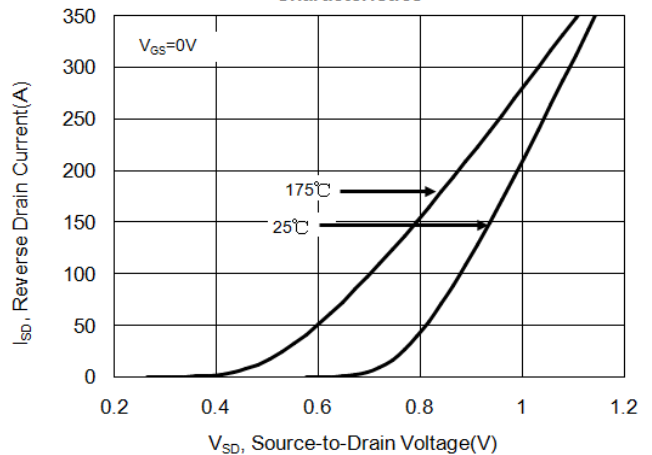
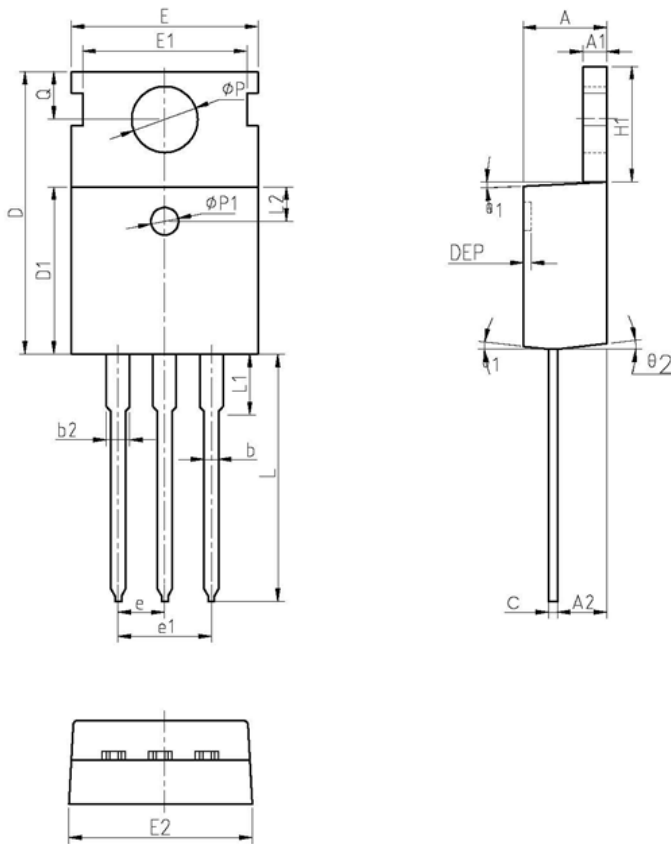


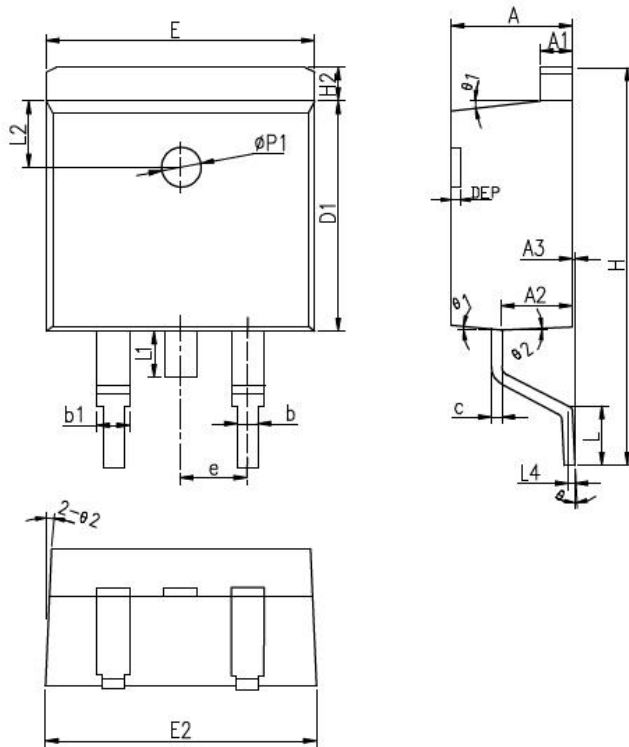
Figure 16. Typical Body Diode Transfer Characteristics



Package Dimensions
TO-220-3L


COMMON DIMENSIONS

SYMBOL	MIN	NOM	MAX	MIN	NOM	MAX
A	4.40	4.57	4.70	0.173	0.180	0.185
A1	1.27	1.30	1.33	0.050	0.051	0.052
A2	2.35	2.40	2.50	0.093	0.094	0.098
b	0.77	0.80	0.90	0.030	0.031	0.035
b2	1.17	1.27	1.36	0.046	0.050	0.054
c	0.48	0.50	0.56	0.019	0.020	0.022
D	15.40	15.60	15.80	0.606	0.614	0.622
D1	9.00	9.10	9.20	0.354	0.358	0.362
DEP	0.05	0.10	0.20	0.002	0.004	0.008
E	9.80	10.00	10.20	0.386	0.394	0.402
E1	-	8.70	-	-	0.343	-
E2	9.80	10.00	10.20	0.386	0.394	0.402
e	2.54		BSC	0.100		BSC
e1	5.08		BSC	0.200		BSC
H1	6.40	6.50	6.60	0.252	0.256	0.260
L	12.75	13.50	13.65	0.502	0.531	0.537
L1	-	3.10	3.30	-	0.122	0.130
L2	2.50		REF	0.098		REF
ϕP	3.50	3.60	3.63	0.138	0.142	0.143
$\phi p1$	3.50	3.60	3.63	0.138	0.142	0.143
Q	2.73	2.80	2.87	0.107	0.110	0.113
$\theta 1$	5°	7°	9°	5°	7°	9°
$\theta 2$	1°	3°	5°	1°	3°	5°
$\theta 3$	1°	3°	5°	1°	3°	5°


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		
θ	0°	5°	8°	0°	5°	8°
θ1	5°	7°	9°	5°	7°	9°
θ2	1°	3°	5°	1°	3°	5°
ΦP1	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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