

40V N-ch Power MOSFET

General Features

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

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

Applications

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

Ordering Information

Part Number	Package	Marking
MXP40N1P5AT	TO-220	MXP40N1P5AT
MXP40N1P5AF	TO-263-2L	MXP40N1P5AF

Absolute Maximum Ratings

$T_C = 25^\circ\text{C}$ 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 $T_C = 100^\circ\text{C}$ ^[2]	268	
I_{DM}	Pulsed Drain Current at $V_{GS} = 10\text{V}^{[2,4]}$	1514	
E_{AS}	Single Pulse Avalanche Energy ($V_{DD} = 30\text{V}$, $V_{GS} = 10\text{V}$, $R_G = 25\Omega$, $L = 1\text{mH}$)	834	mJ
P_D	Power Dissipation	397	W
	Derating Factor above 25°C	2.6	$\text{W}/^\circ\text{C}$
T_L	Soldering Temperature Distance of 1.6mm from case for 10 seconds	300	$^\circ\text{C}$
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			0.38	$^\circ\text{C}/\text{W}$
$R_{\theta JA}$	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	$V_{\text{GS}}=0\text{V}$, $I_{\text{D}}=250\text{uA}$
I_{DSS}	Drain-to-Source Leakage Current			1	μA	$V_{\text{DS}}=32\text{V}$, $V_{\text{GS}}=0\text{V}$
I_{GSS}	Gate-to-Source Leakage Current			± 100	nA	$V_{\text{GS}}=\pm 20\text{V}$, $V_{\text{DS}}=0\text{V}$

ON Characteristics

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

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$R_{\text{DS(ON)}}$	Static Drain-to-Source On-Resistance	--	1.2	1.5	$\text{m}\Omega$	$V_{\text{GS}}=10\text{V}$, $I_{\text{D}}=192\text{A}$ ^[5]
$V_{\text{GS(TH)}}$	Gate Threshold Voltage	2.0	--	4.0	V	$V_{\text{DS}} = V_{\text{GS}}$, $I_{\text{D}}=250\text{uA}$

Dynamic Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
C_{iss}	Input Capacitance		9.6		nF	$V_{\text{GS}}=0\text{V}$, $V_{\text{DS}}=25\text{V}$, $f=1.0\text{MHz}$
C_{rss}	Reverse Transfer Capacitance		0.37			
C_{oss}	Output Capacitance		1.55			
R_g	Gate Series Resistance		2.0		Ω	
Q_g	Total Gate Charge		174		nC	$V_{\text{DD}}=20\text{V}$, $I_{\text{D}}=120\text{A}$, $V_{\text{GS}}=10\text{V}$
Q_{gs}	Gate-to-Source Charge		41			
Q_{gd}	Gate-to-Drain (Miller) Charge		45			

Resistive Switching Characteristics

Essentially independent of operating temperature

Symbol	Parameter	Min.	Typ.	Max.	Unit	Test Conditions
$t_{\text{d(on)}}$	Turn-on Delay Time		28		ns	$V_{\text{DD}}=20\text{V}$, $I_{\text{D}}=100\text{A}$, $V_{\text{GS}}=10\text{V}$, $R_{\text{G}}=2.5\Omega$
t_{rise}	Rise Time		28			
$t_{\text{d(off)}}$	Turn-off Delay Time		125			
t_{fall}	Fall Time		30			

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	$I_{\text{S}}=120\text{A}$, $V_{\text{GS}}=0\text{V}$
t_{rr}	Reverse Recovery Time		73		ns	
Q_{rr}	Reverse Recovery Charge		147		nC	$V_{\text{GS}}=0\text{V}$ $I_{\text{F}}=20\text{A}$, $di/dt=100\text{A}/\mu\text{s}$

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 $\leq 380\mu\text{s}$; duty cycle $\leq 2\%$.

Typical Characteristics

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

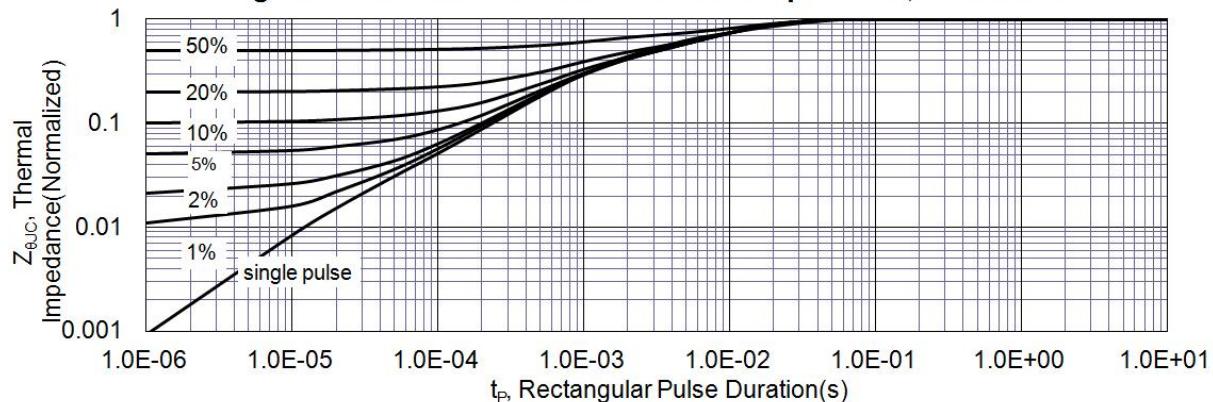


Figure 2. Maximum Power Dissipation vs. Case Temperature

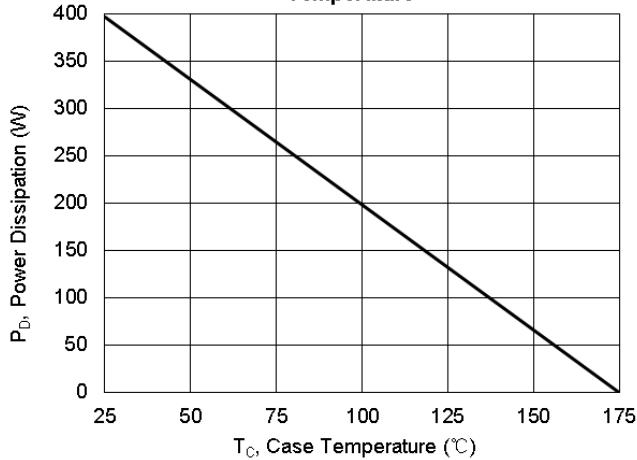


Figure 3. Maximum Continuous Drain Current vs Case Temperature

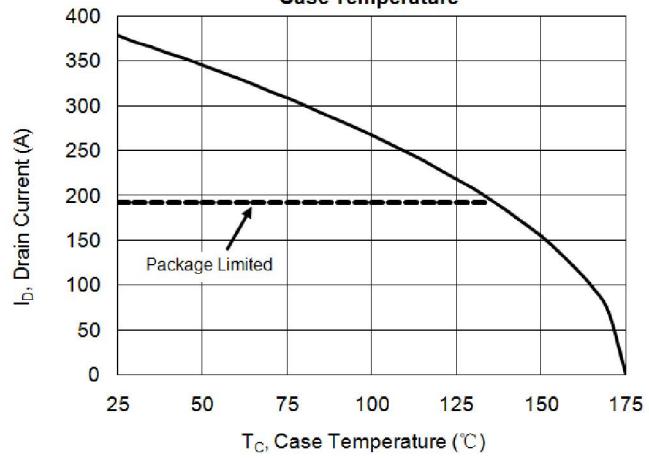


Figure 4. Typical Output Characteristics

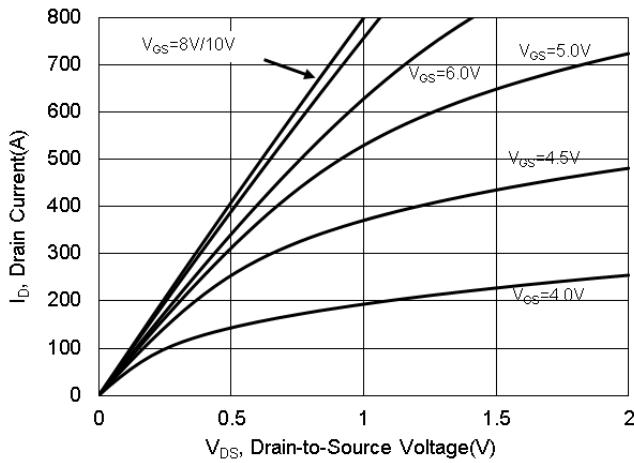


Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage

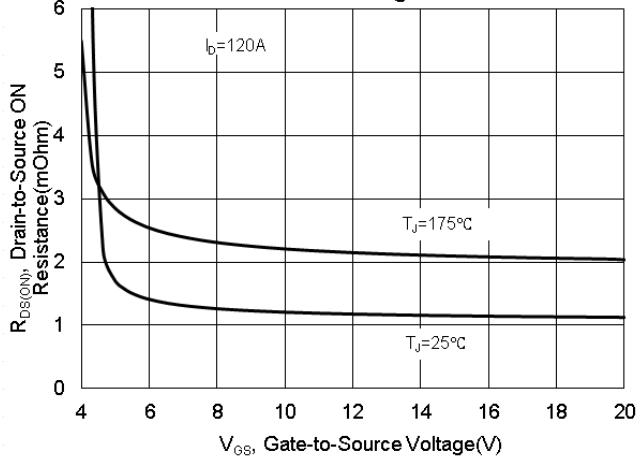
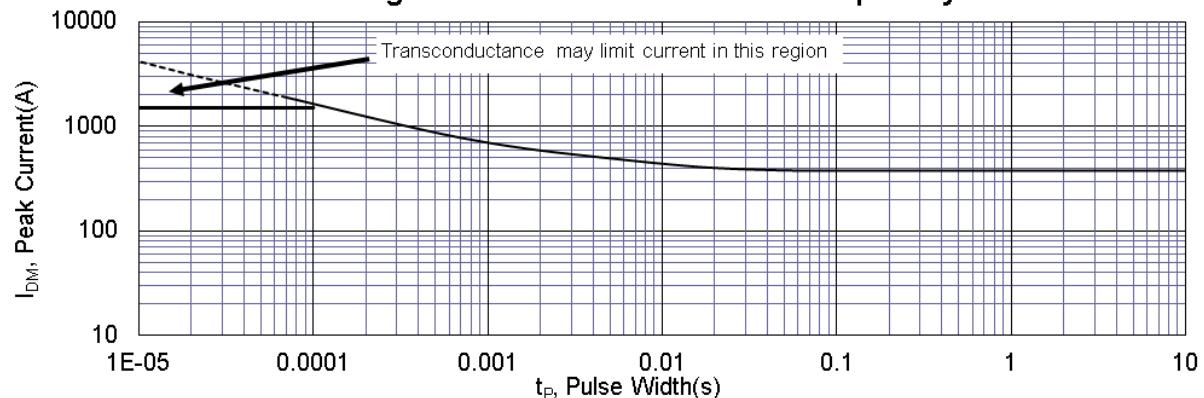
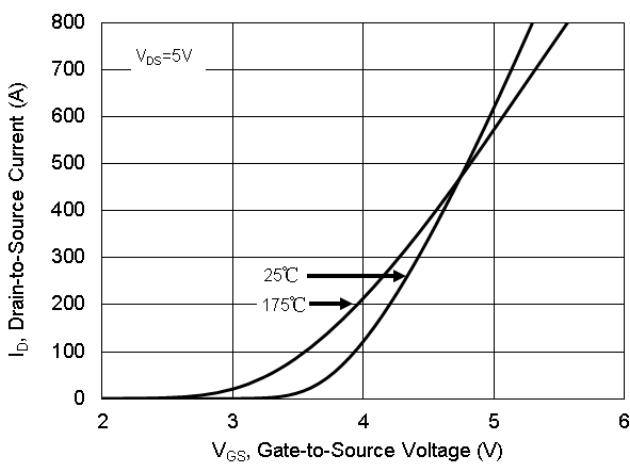
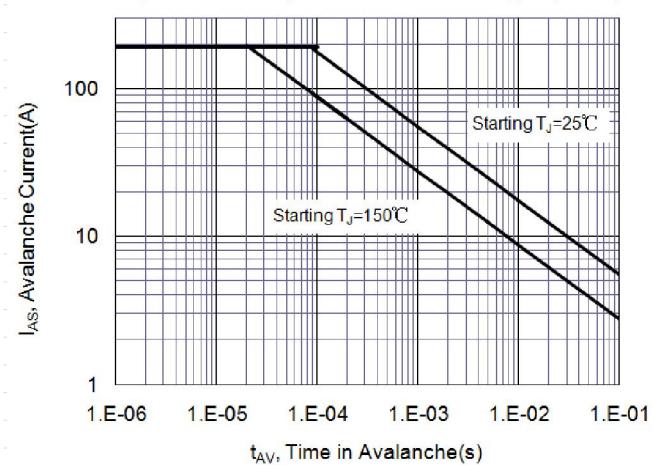
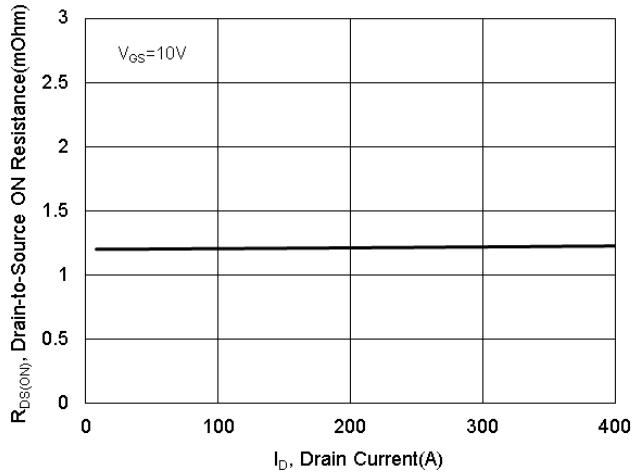
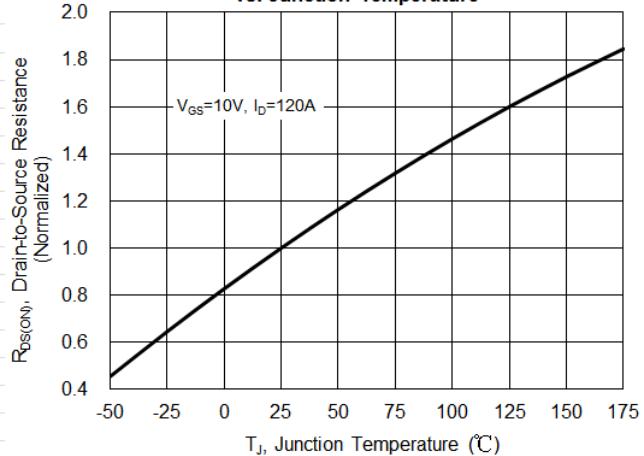
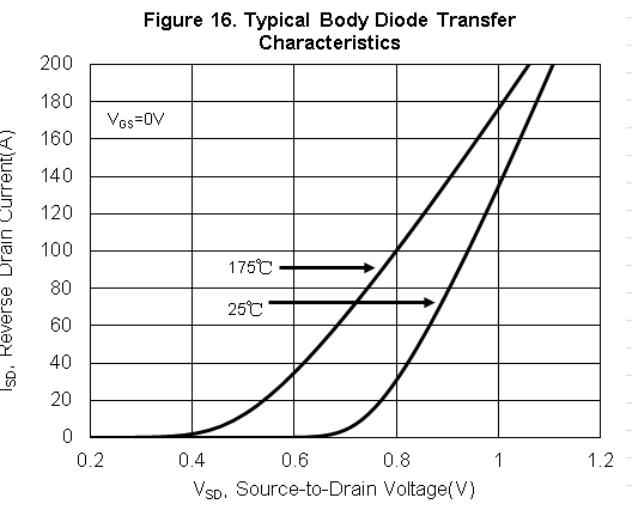
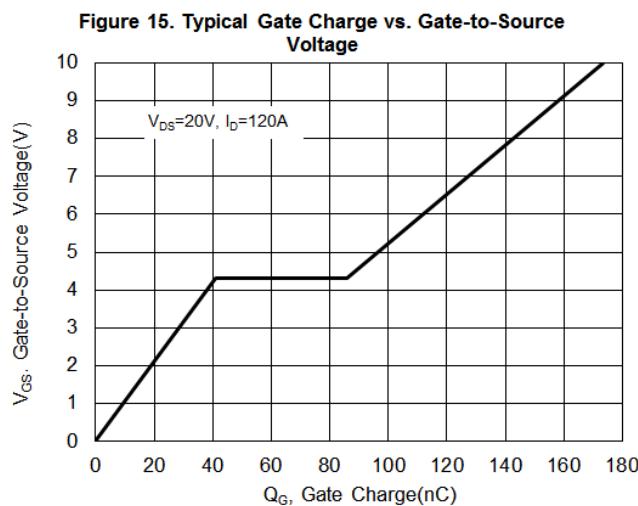
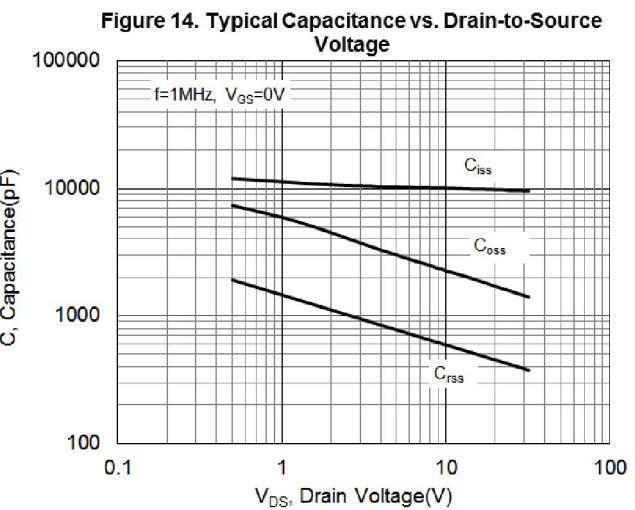
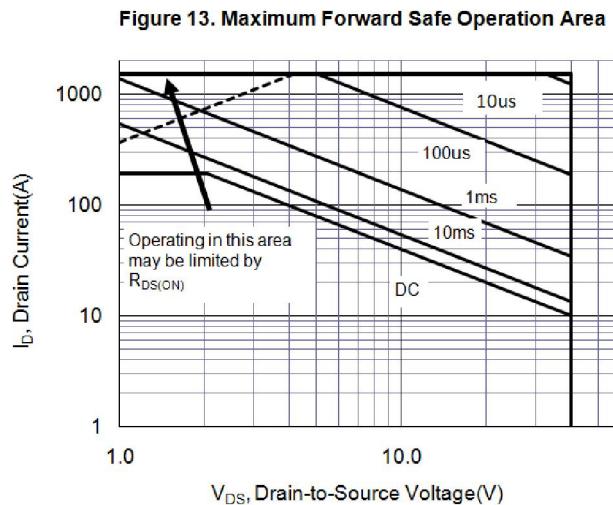
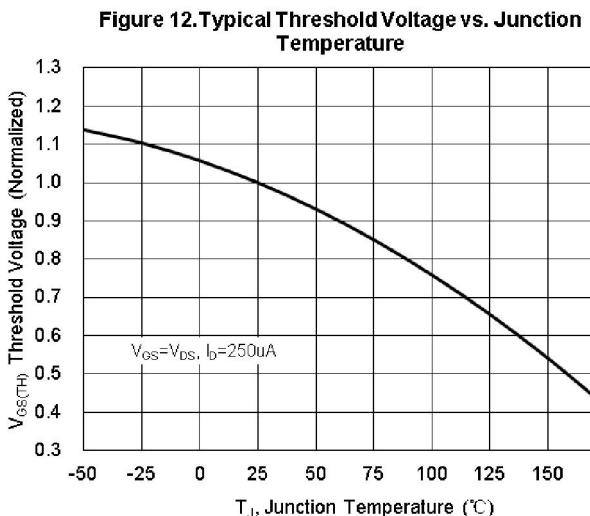
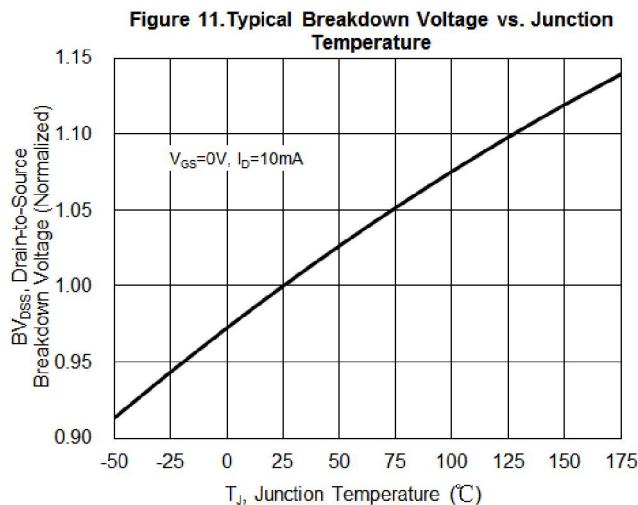
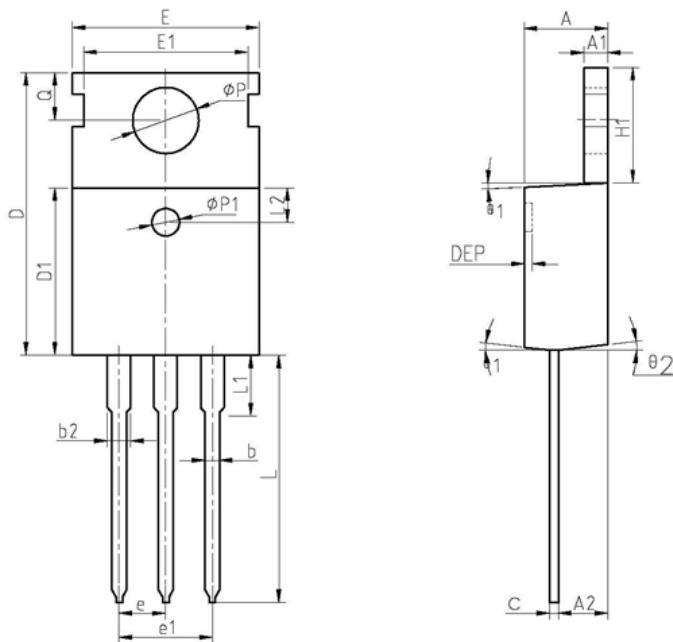


Figure 6. Maximum Peak Current Capability

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




Package Dimensions

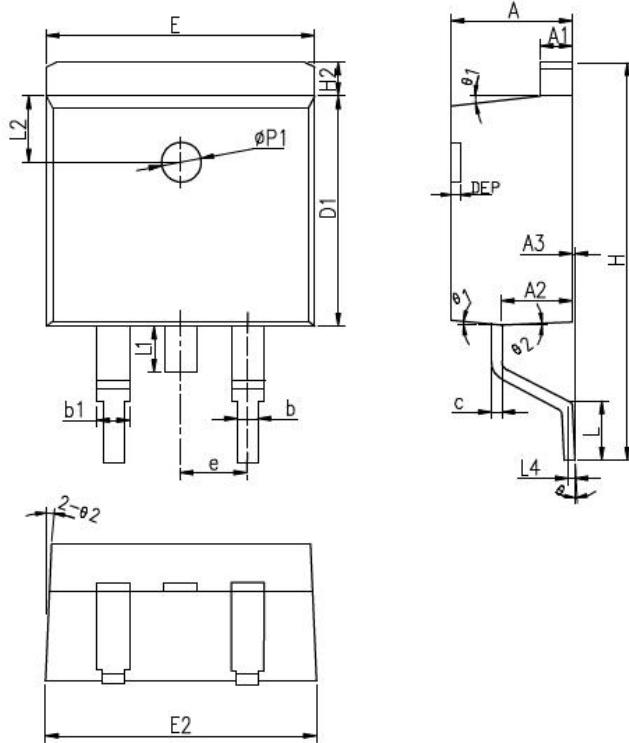
TO-220-3L



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
DEF	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	BS _C	—	0.100	BS _C	—
e1	5.08	BS _C	—	0.200	BS _C	—
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	—
Φ _P	3.50	3.60	3.63	0.138	0.142	0.143
Φ _{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
θ ₁	5°	7°	9°	5°	7°	9°
θ ₂	1°	3°	5°	1°	3°	5°
θ ₃	1°	3°	5°	1°	3°	5°



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		
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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