

## 40V N-ch Power MOSFET

### General Features

- Proprietary New Trench Technology
- $R_{DS(ON),typ.} = 1.3m\Omega @ V_{GS} = 10V$
- Low Gate Charge Minimize Switching Loss
- Fast Recovery Body Diode

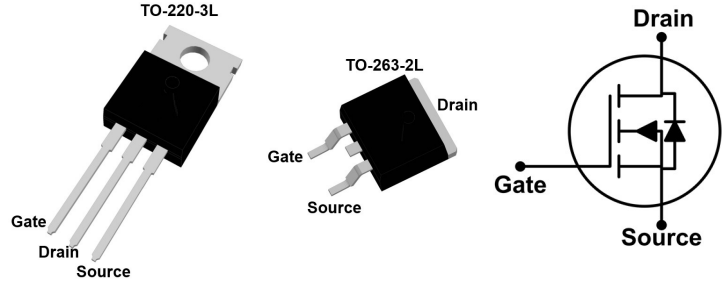
$BV_{DSS}$	$R_{DS(ON),max.}$	$I_D^{[2]}$
40V	1.5m $\Omega$	347A

### Applications

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

### Ordering Information

Part Number	Package	Marking
FTP40N1P5L	TO-220-3L	40N1P5L
FTB40N1P5L	TO-263-2L	40N1P5L



### 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>	347	A
	Continuous Drain Current <sup>[3]</sup>	192	
	Continuous Drain Current at $T_C = 100^\circ C$ <sup>[2]</sup>	245	
$I_{DM}$	Pulsed Drain Current at $V_{GS} = 10V$ <sup>[2,4]</sup>	1388	
$E_{AS}$	Single Pulse Avalanche Energy ( $V_{DD} = 20V, V_{GS} = 10V, R_G = 25\Omega, L = 1mH$ )	648	mJ
$P_D$	Power Dissipation	341	W
	Derating Factor above $25^\circ C$	2.3	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			0.44	$^\circ C/W$
$R_{\theta JA}$	Thermal Resistance, Junction-to-Ambient			63	

## 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	--	1.3	1.5	m $\Omega$	$V_{GS}=10V, I_D=80A^{[5]}$
		--	1.7	2.3	m $\Omega$	$V_{GS}=4.5V, I_D=80A^{[5]}$
$V_{GS(TH)}$	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		0.41			
$C_{oss}$	Output Capacitance		1.5			
$R_g$	Gate Series Resistance		1.7		$\Omega$	$f=1.0MHz$
$Q_g$	Total Gate Charge		83		nC	$V_{DD}=20V, I_D=120A, V_{GS}=4.5V$
			166			
$Q_{gs}$	Gate-to-Source Charge		27			$V_{DD}=20V, I_D=120A, V_{GS}=10V$
$Q_{gd}$	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 <sup>[2]</sup>			347	A	Maximum Ratings
$V_{SD}$	Diode Forward Voltage		0.9	1.2	V	$I_S=80A, V_{GS}=0V$
$t_{rr}$	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 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

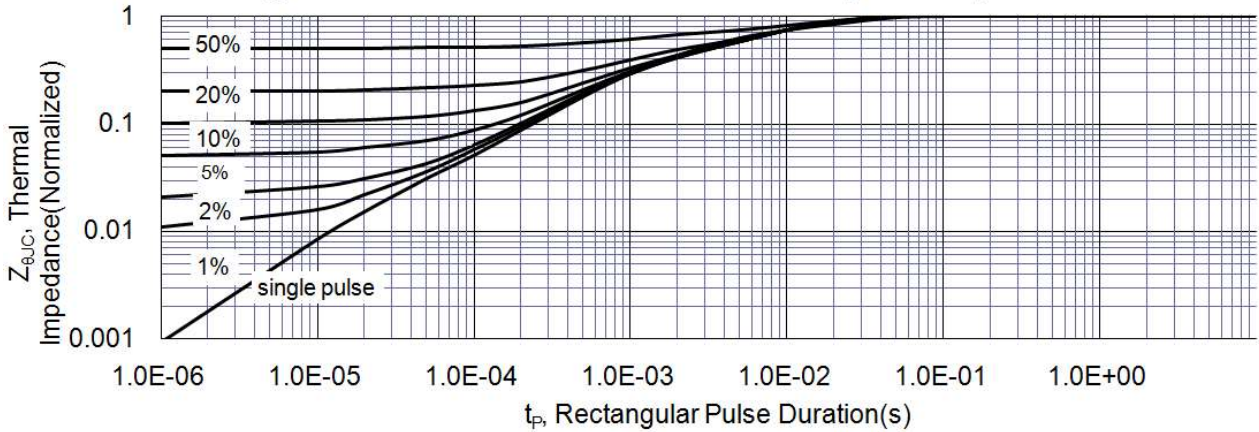


Figure 2. Maximum Power Dissipation vs. Case Temperature

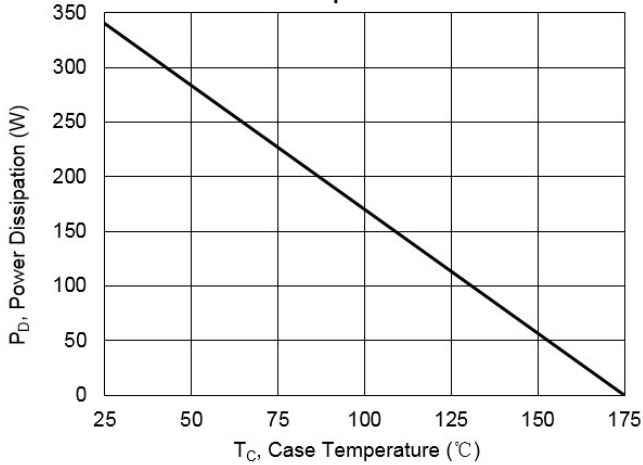


Figure 3. Maximum Continuous Drain Current vs Case Temperature

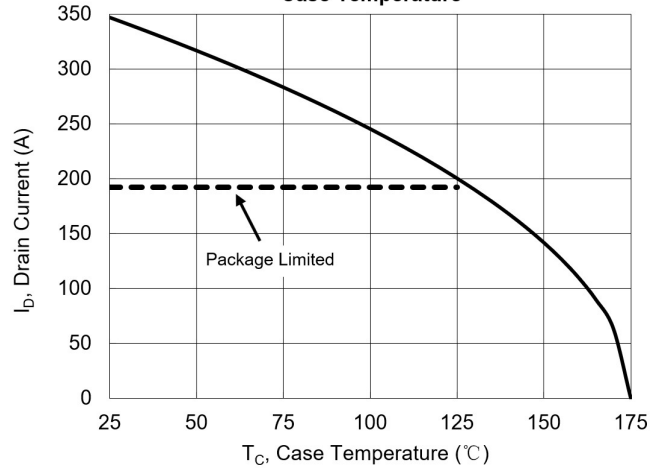


Figure 4. Typical Output Characteristics

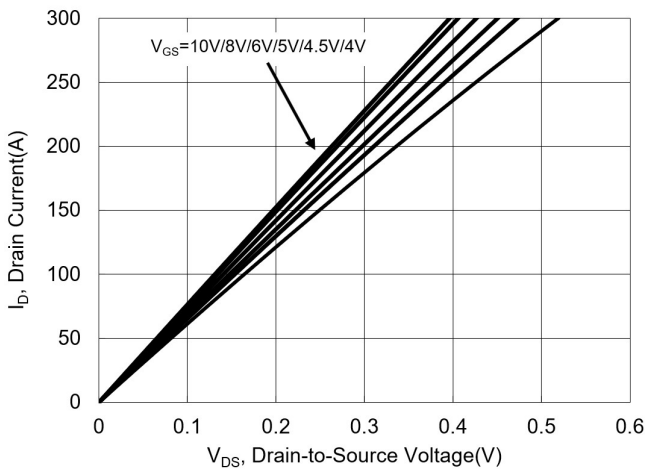


Figure 5. Typical Drain-to-Source ON Resistance vs. Gate Voltage

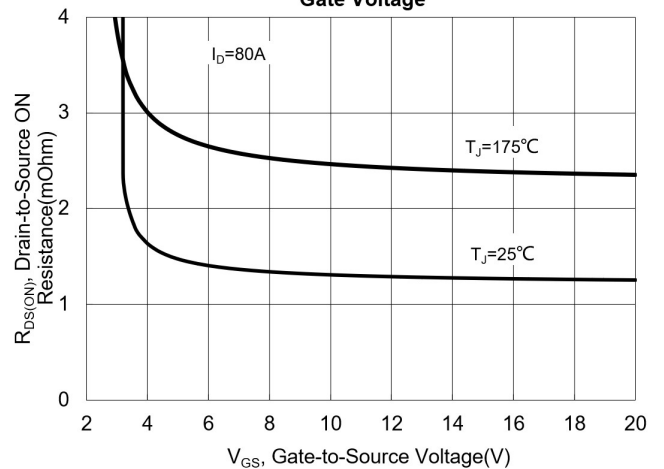


Figure 6. Maximum Peak Current Capability

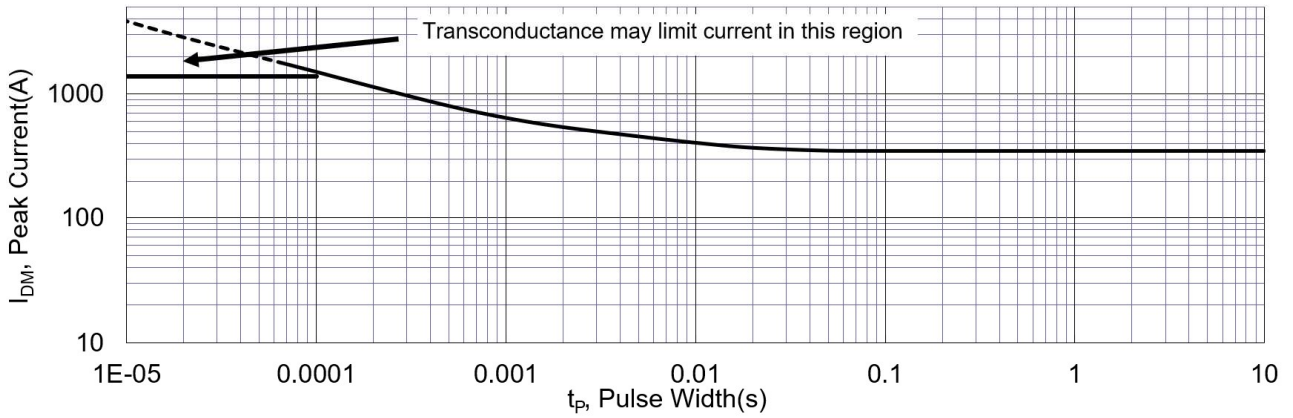


Figure 7. Typical Transfer Characteristics

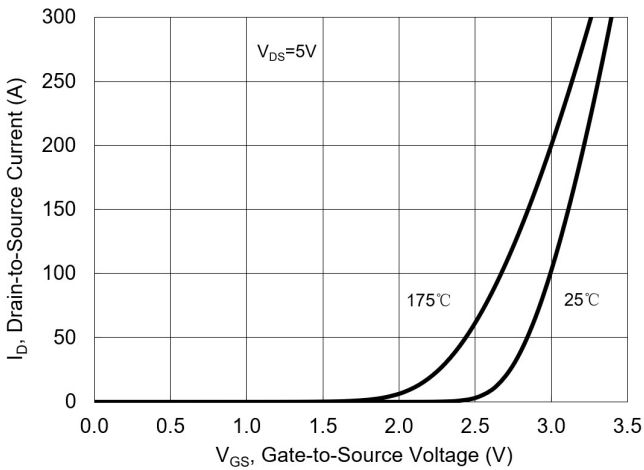


Figure 8. Unclamped Inductive Switching Capability

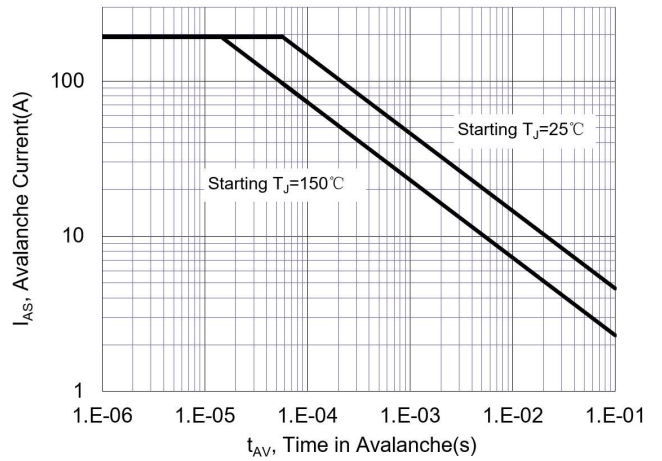


Figure 9. Typical Drain-to-Source ON Resistance

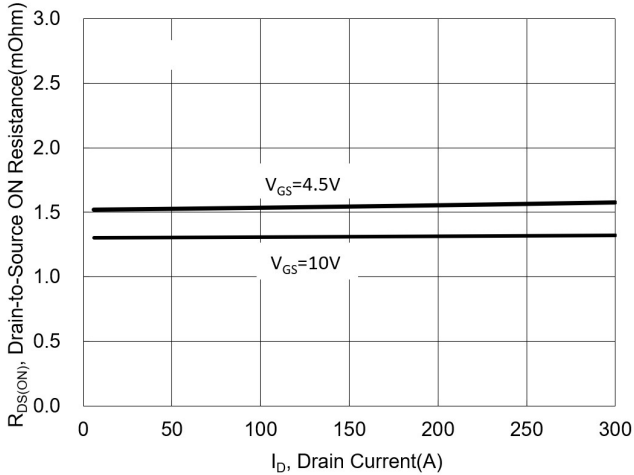


Figure 10. Typical Drain-to-Source On Resistance vs. Junction Temperature

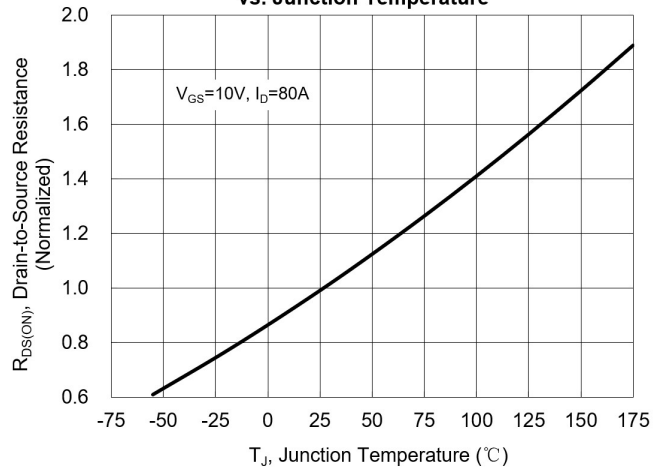


Figure 11. Typical Breakdown Voltage vs. Junction Temperature

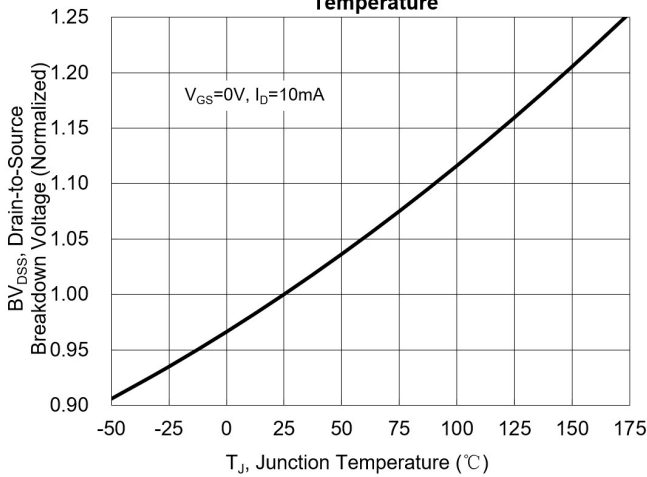


Figure 12. Typical Threshold Voltage vs. Junction Temperature

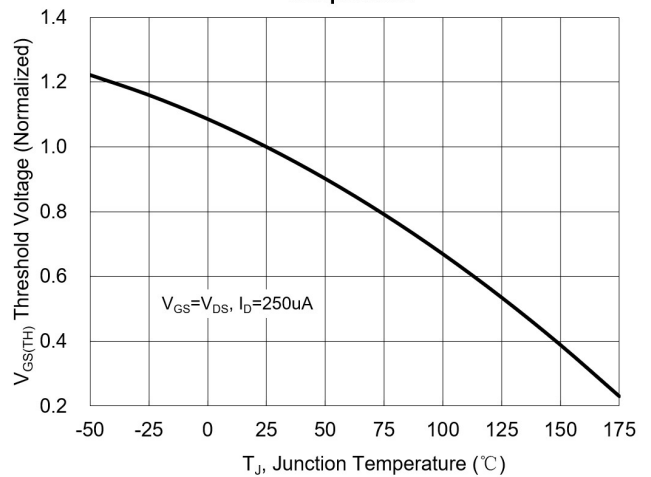


Figure 13. Maximum Forward Safe Operation Area

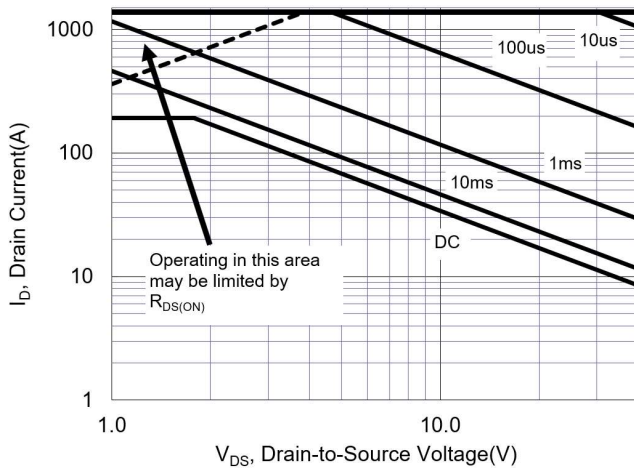


Figure 14. Typical Capacitance vs. Drain-to-Source Voltage

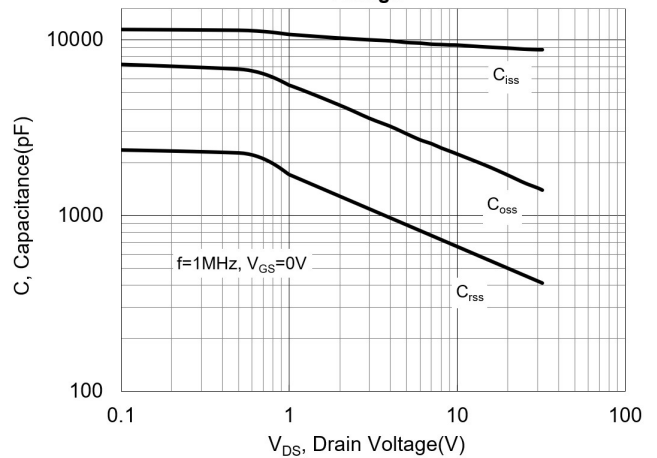


Figure 15. Typical Gate Charge vs. Gate-to-Source Voltage

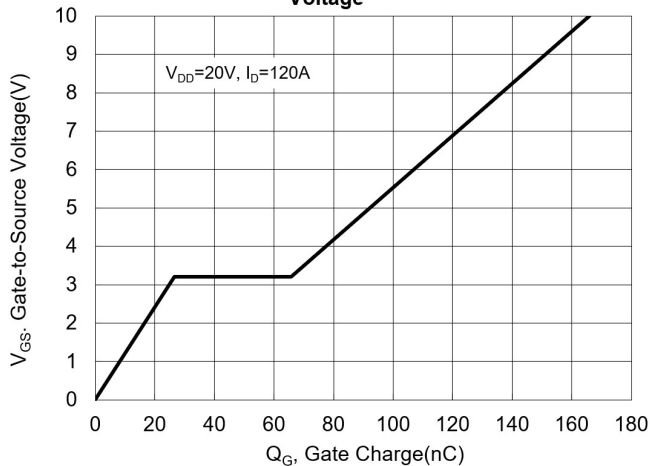
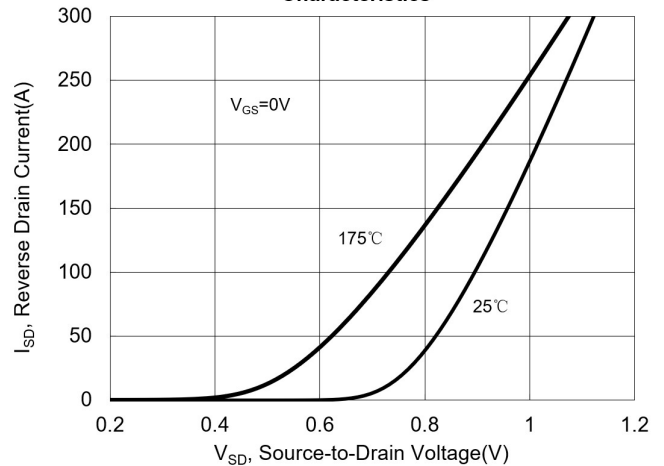
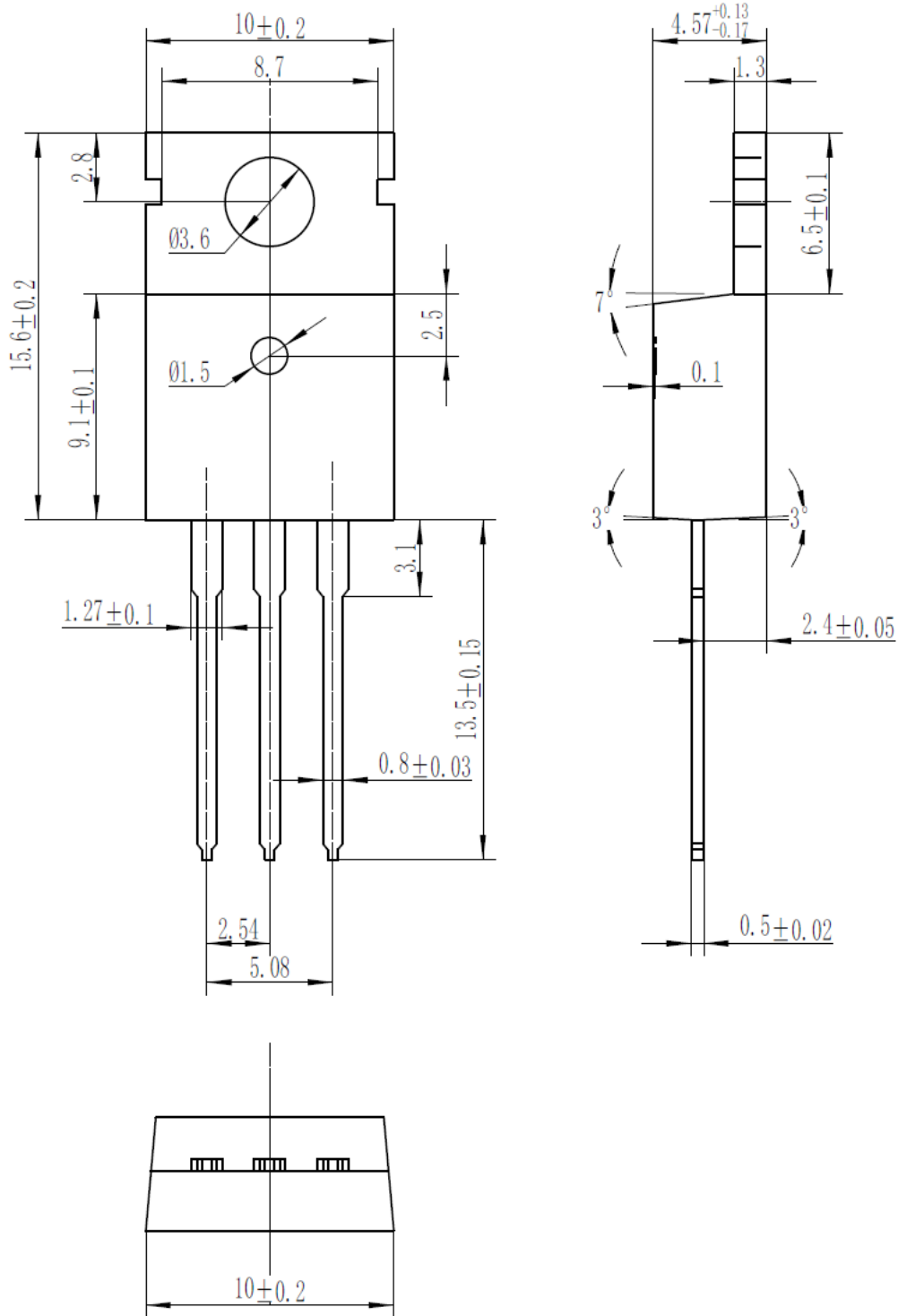


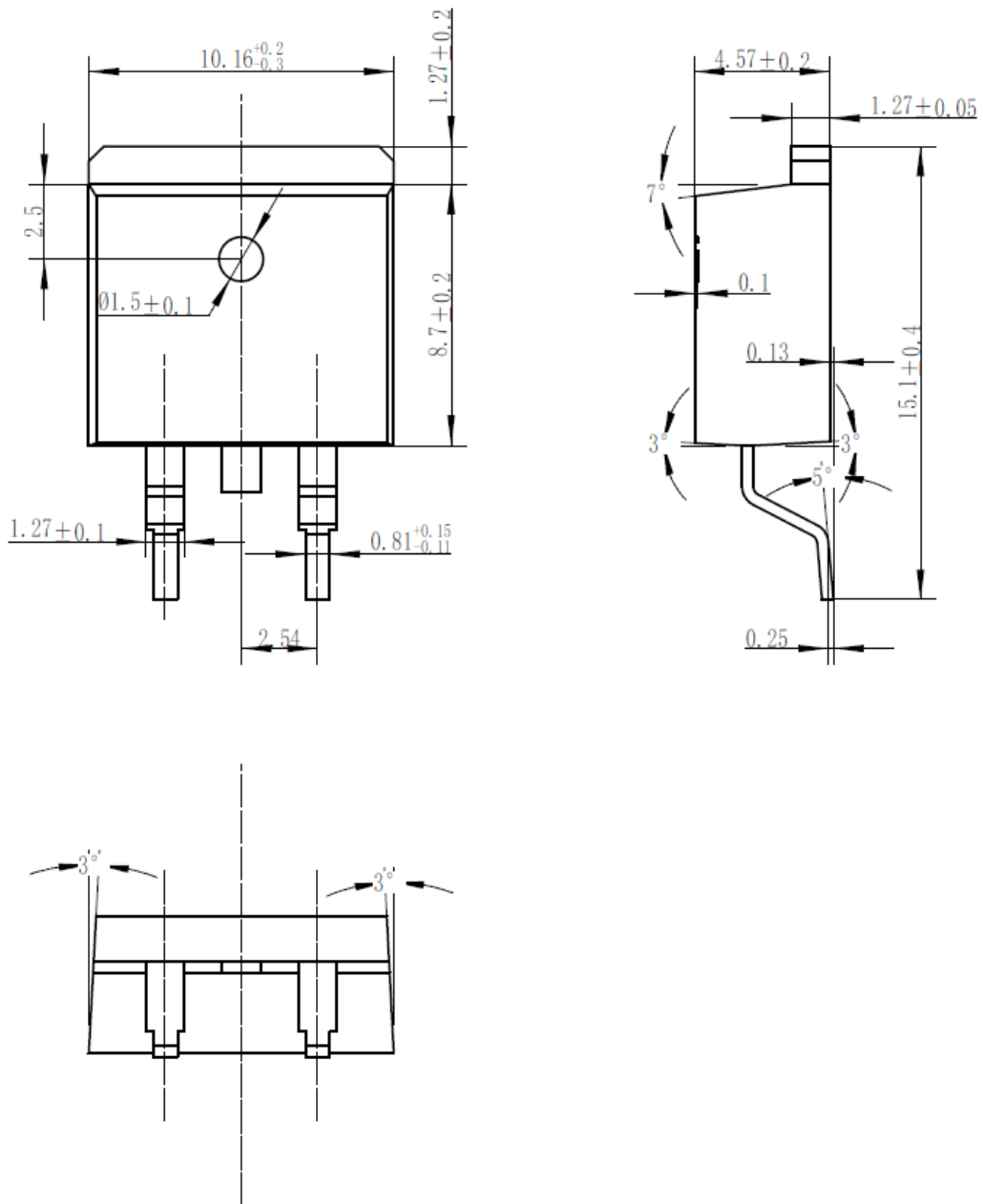
Figure 16. Typical Body Diode Transfer Characteristics



Package Dimensions

TO-220-3L





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