

## N-Channel 60 V (D-S) Super Junction Power MOSFET

PRODUCT SUMMARY		
$V_{DS}$ (V)	$R_{DS(on)}$ ( $\Omega$ )	$I_D$ (A) <sup>a</sup>
60	0.0022 at $V_{GS} = 10$ V	190

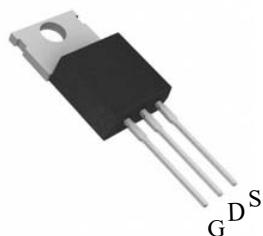
### FEATURES

- 175 °C Junction Temperature
- DT-Trench Power MOSFET
- Material categorization:

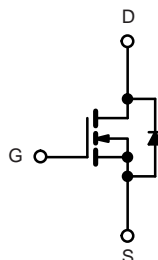


**RoHS**  
COMPLIANT

TO-220 Pin Configuration



Top View



N-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25$ °C, unless otherwise noted)				
Parameter		Symbol	Limit	Unit
Gate-Source Voltage		$V_{GS}$	$\pm 20$	V
Continuous Drain Current ( $T_J = 175$ °C) <sup>b</sup>	$T_C = 25$ °C	$I_D$	190	A
	$T_C = 100$ °C		170 <sup>a</sup>	
Pulsed Drain Current		$I_{DM}$	760	
Continuous Source Current (Diode Conduction)		$I_S$	190 <sup>a</sup>	
Avalanche Current		$I_{AS}$	110	
Single Avalanche Energy (Duty Cycle $\leq 1$ %)	$L = 0.1$ mH	$E_{AS}$	570	mJ
Maximum Power Dissipation	$T_C = 25$ °C	$P_D$	205	W
	$T_A = 25$ °C		3 <sup>b</sup> , 8.5 <sup>b, c</sup>	
Operating Junction and Storage Temperature Range		$T_J, T_{stg}$	- 55 to 175	°C

THERMAL RESISTANCE RATINGS					
Parameter		Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>a</sup>	$t \leq 10$ sec	$R_{thJA}$	15	20	°C/W
	Steady State		40	50	
Maximum Junction-to-Case		$R_{thJC}$	0.85	1.1	

Notes:

a. Package limited.

b. Surface mounted on 1" x 1" FR4 board.

c.  $t \leq 10$  s.

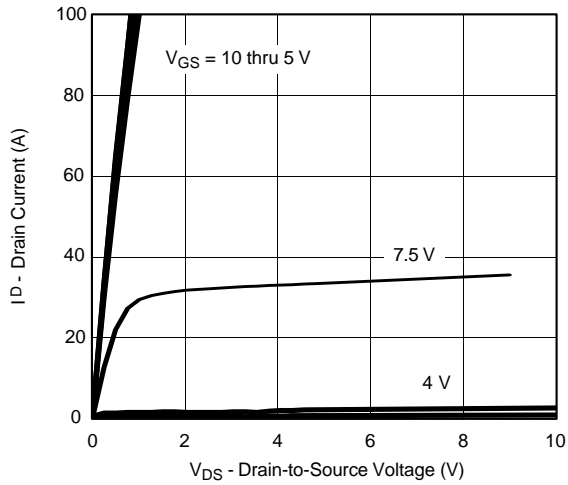
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise noted)						
Parameter	Symbol	Test Conditions	Min.	Typ. <sup>a</sup>	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	1		3.5	
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}$			1	$\mu\text{A}$
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			50	
		$V_{DS} = 48\text{ V}, V_{GS} = 0\text{ V}, T_J = 175\text{ }^\circ\text{C}$			250	
On-State Drain Current <sup>b</sup>	$I_{D(on)}$	$V_{DS} = 5\text{ V}, V_{GS} = 10\text{ V}$	190			A
Drain-Source On-State Resistance <sup>b</sup>	$R_{DS(on)}$	$V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		0.0022	0.0030	$\Omega$
		$V_{GS} = 10\text{ V}, I_D = 20\text{ A}, T_J = 125\text{ }^\circ\text{C}$		0.0029	0.0039	
		$V_{GS} = 10\text{ V}, I_D = 10\text{ A}, T_J = 175\text{ }^\circ\text{C}$		0.0035	0.0043	
Forward Transconductance <sup>b</sup>	$g_{fs}$	$V_{DS} = 48\text{ V}, I_D = 20\text{ A}$		55		S
<b>Dynamic</b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = 48\text{ V}, f = 1\text{ MHz}$		8560		$\mu\text{F}$
Output Capacitance	$C_{oss}$			1150		
Reverse Transfer Capacitance	$C_{rss}$			73		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = 48\text{ V}, V_{GS} = 10\text{ V}, I_D = 20\text{ A}$		65	73	nC
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			11		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			8		
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = 48\text{ V}, R_L = 0.6\text{ }\Omega$ $I_D \cong 20\text{ A}, V_{GEN} = 10\text{ V}, R_g = 2.5\text{ }\Omega$		11	20	ns
Rise Time <sup>c</sup>	$t_r$			6	15	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			51	70	
Fall Time <sup>c</sup>	$t_f$			13	20	
<b>Source-Drain Diode Ratings and Characteristics</b> ( $T_C = 25\text{ }^\circ\text{C}$ )						
Pulsed Current	$I_{SM}$				760	A
Diode Forward Voltage	$V_{SD}$	$I_F = 20\text{ A}, V_{GS} = 0\text{ V}$		0.8	1.2	V
Reverse Recovery Time	$t_{rr}$	$I_F = 20\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		45	100	ns

**Notes:**

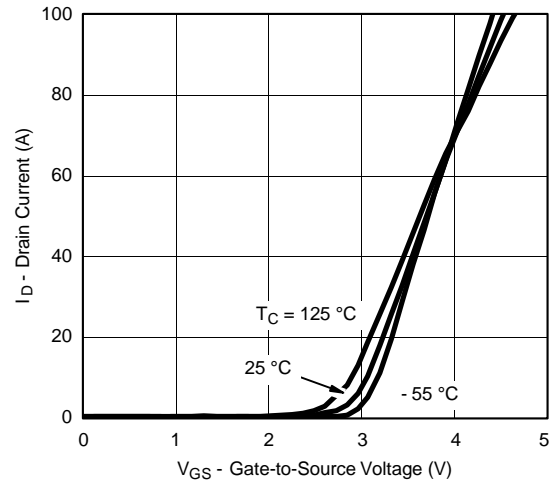
- For design aid only; not subject to production testing.
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Independent of operating temperature.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

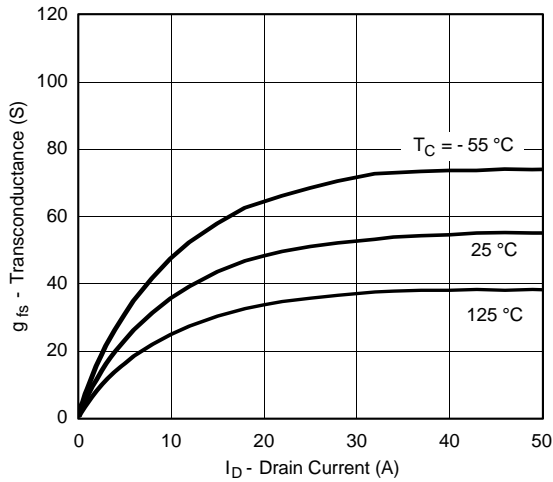
**TYPICAL CHARACTERISTICS** (25 °C unless noted)



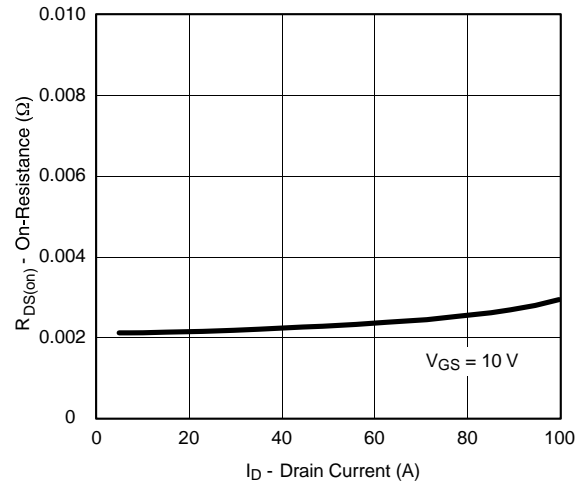
**Output Characteristics**



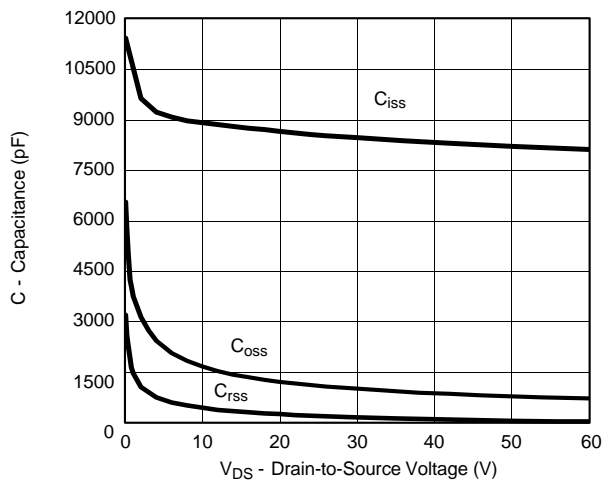
**Transfer Characteristics**



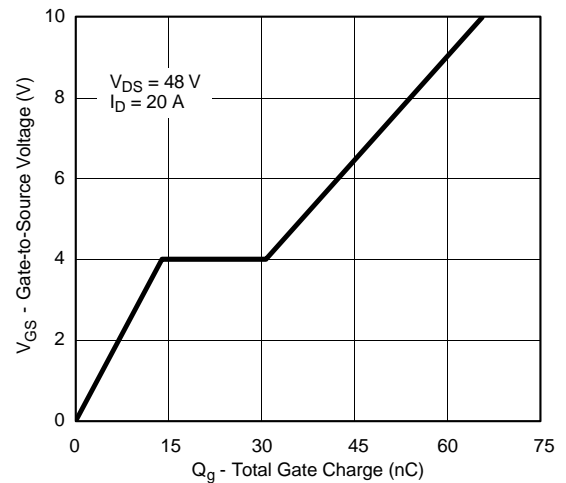
**Transconductance**



**On-Resistance vs. Drain Current**

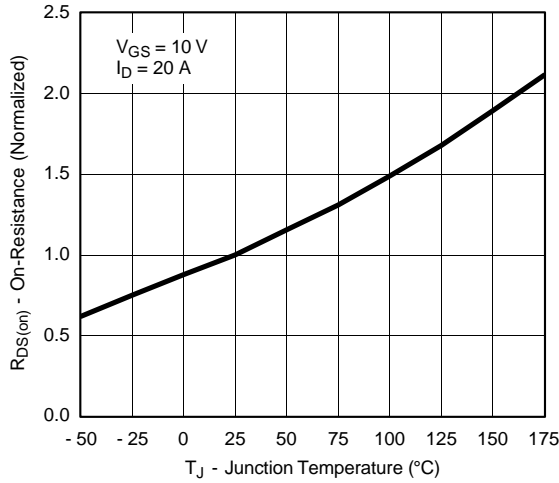


**Capacitance**

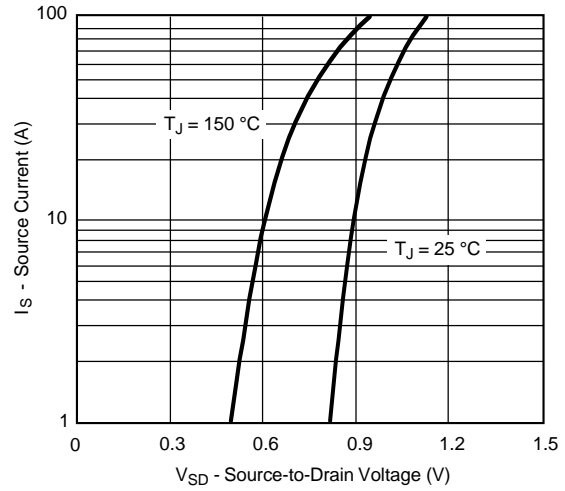


**Gate Charge**

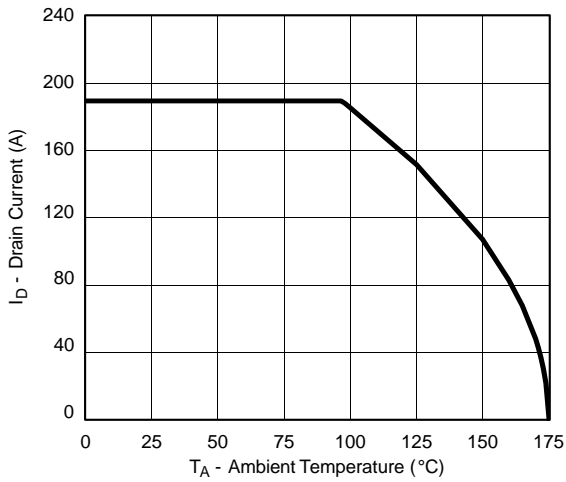
**TYPICAL CHARACTERISTICS** (25 °C unless noted)



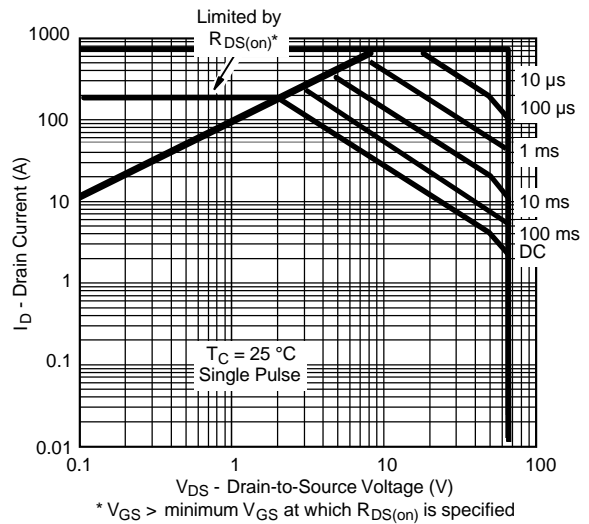
**On-Resistance vs. Junction Temperature**



**Source-Drain Diode Forward Voltage**

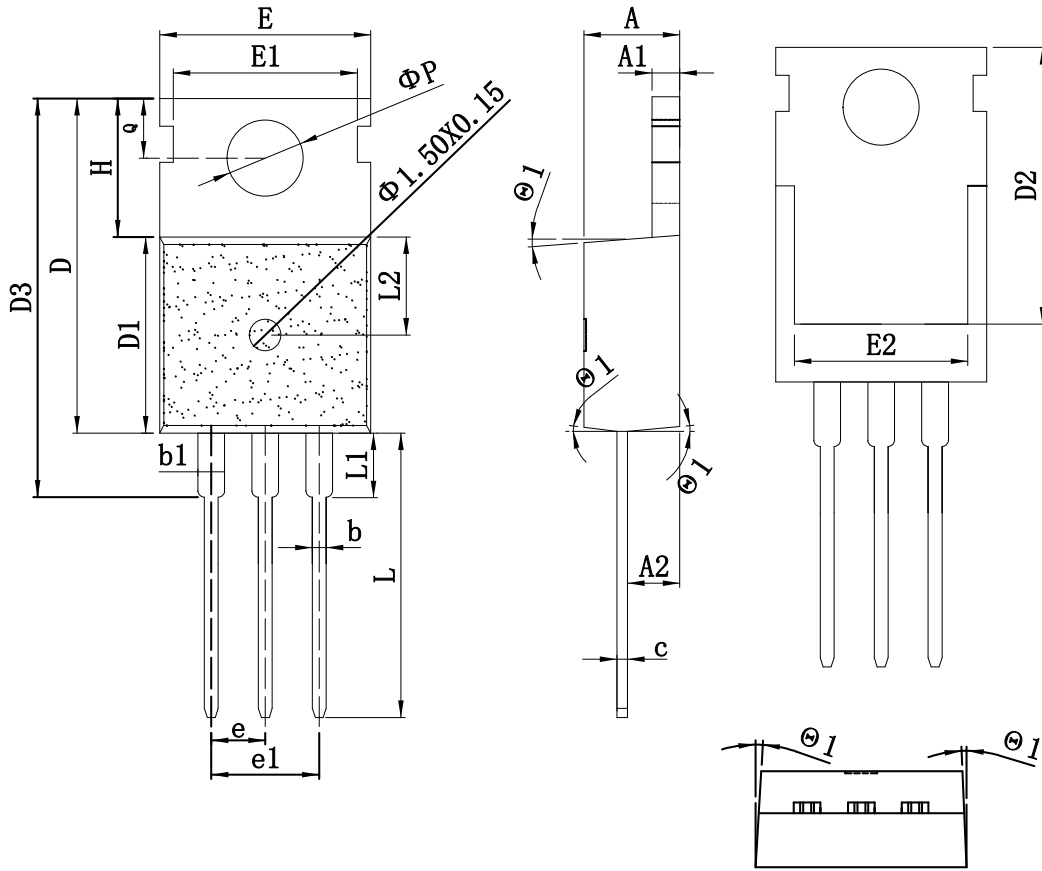


**Maximum Drain Current vs. Ambient Temperature**



**Safe Operating Area**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $R_{DS(on)}$  is specified

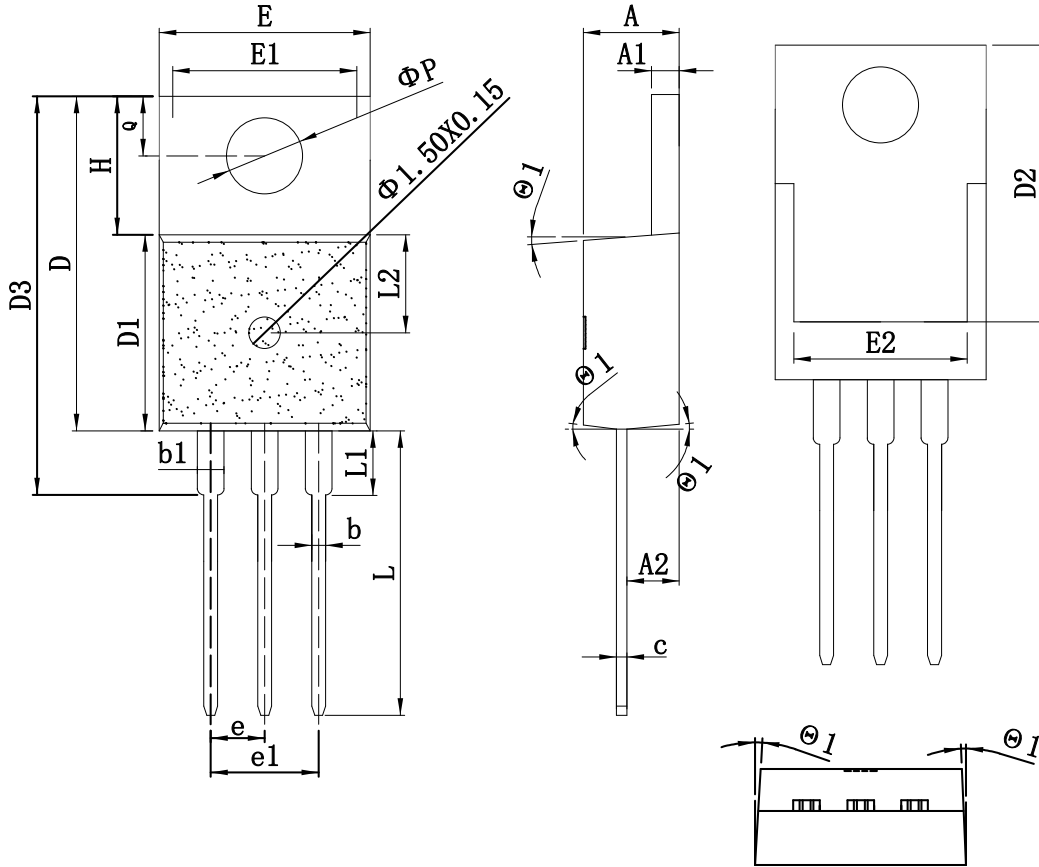
**TO-220\_3L-A PACKAGE OUTLINE**



COMMON DIMENSIONS  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	$\phi P$	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	$\theta$	2°	-	7°

**TO-220\_3L-B PACKAGE OUTLINE**



**COMMON DIMENSIONS**  
(UNITS OF MEASURE=MILLIMETER)

SYMBOL	mm			SYMBOL	mm		
	MIN	TYP	MAX		MIN	TYP	MAX
A	4.15	4.50	4.80	E1	8.25	8.70	9.15
A1	1.15	1.30	1.50	E2	7.20	8.00	8.80
A2	2.10	2.40	2.65	e	2.38	2.54	2.74
b	0.65	0.80	1.00	e1	5.08REF		
b1	1.10	1.33	1.80	H	6.20	6.50	6.90
c	0.35	0.50	0.65	L	12.75	13.28	13.70
D	14.25	15.75	16.15	L1	-	-	3.50
D1	8.70	9.20	9.60	L2	2.30	4.65	7.00
D2	12.30	13.10	13.85	φP	3.40	3.65	3.85
D3	16.20	18.80	20.60	Q	2.50	2.80	3.00
E	8.68	10.02	11.00	θ	2°	-	7°

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