

## P-Channel 60 V (D-S) MOSFET

PRODUCT SUMMARY			
V <sub>DS</sub> (V)	R <sub>DS(on)</sub> (Ω)	I <sub>D</sub> (A) <sup>d</sup>	Q <sub>g</sub> (Typ)
- 60	0.053 at V <sub>GS</sub> = - 10 V	- 25	26
	0.062 at V <sub>GS</sub> = - 4.5 V	- 20	

### FEATURES

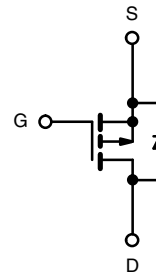
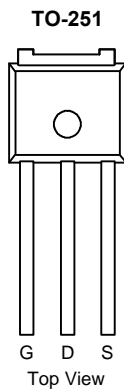
- Halogen-free According to IEC 61249-2-21 Definition
- TrenchFET<sup>®</sup> Power MOSFET
- 100 % UIS Tested
- Compliant to RoHS Directive 2002/95/EC



**RoHS**  
COMPLIANT  
HALOGEN  
**FREE**  
Available

### APPLICATIONS

- High Side Switch for Full Bridge Converter
- DC/DC Converter for LCD Display



P-Channel MOSFET

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise note)			
Parameter	Symbol	Limit	Unit
Drain-Source Voltage	V <sub>DS</sub>	- 60	V
Gate-Source Voltage	V <sub>GS</sub>	± 20	
Continuous Drain Current (T <sub>J</sub> = 150 °C)	I <sub>D</sub>	T <sub>C</sub> = 25 °C	- 25
		T <sub>C</sub> = 125 °C	- 20
Pulsed Drain Current	I <sub>DM</sub>	- 100	A
Avalanche Current, Single Pulse	I <sub>AS</sub>	- 22	
Repetitive Avalanche Energy, Single Pulse <sup>a</sup>	E <sub>AS</sub>	24.2	mJ
Power Dissipation	P <sub>D</sub>	T <sub>C</sub> = 25 °C	38.5 <sup>c</sup>
		T <sub>A</sub> = 25 °C	2.3 <sup>b, c</sup>
Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>stg</sub>	- 55 to 150	°C

THERMAL RESISTANCE RATINGS				
Parameter	Symbol	Typical	Maximum	Unit
Maximum Junction-to-Ambient <sup>b</sup>	R <sub>thJA</sub>	t ≤ 10 s	17	21
		Steady State	45	55
Maximum Junction-to-Case	R <sub>thJC</sub>	2.7	3.25	°C/W

Notes:

- a. Duty cycle ≤ 1 %.
- b. When mounted on 1" square PCB (FR-4 material).
- c. See SOA curve for voltage derating.
- d. Based up on T<sub>C</sub> = 25 °C.

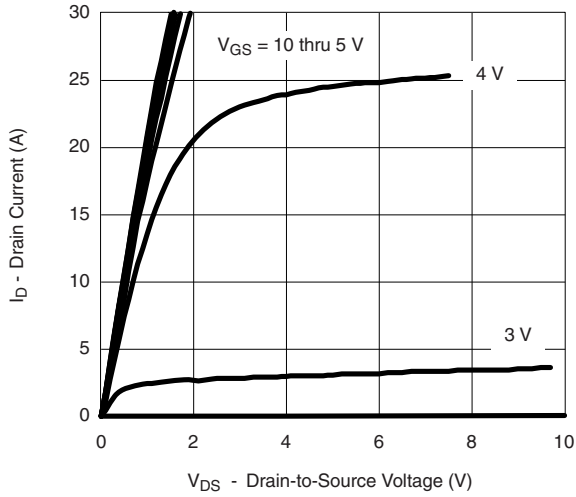
<b>SPECIFICATIONS</b> ( $T_J = 25\text{ }^\circ\text{C}$ , unless otherwise note)						
Parameter	Symbol	Test Conditions	Min .	Typ.	Max.	Unit
<b>Static</b>						
Drain-Source Breakdown Voltage	$V_{DS}$	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$	- 60			V
Gate Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$	- 1		- 3	V
Gate-Body Leakage	$I_{GSS}$	$V_{DS} = 0\text{ V}, V_{GS} = \pm 20\text{ V}$			$\pm 100$	nA
Zero Gate Voltage Drain Current	$I_{DSS}$	$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}$			- 1	$\mu\text{A}$
		$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$			- 50	
		$V_{DS} = -60\text{ V}, V_{GS} = 0\text{ V}, T_J = 150\text{ }^\circ\text{C}$			- 125	
On-State Drain Current <sup>a</sup>	$I_{D(on)}$	$V_{DS} = -5\text{ V}, V_{GS} = -10\text{ V}$	- 30			A
Drain-Source On-State Resistance <sup>a</sup>	$R_{DS(on)}$	$V_{GS} = -10\text{ V}, I_D = -10\text{ A}$		0.053	0.060	$\Omega$
		$V_{GS} = -10\text{ V}, I_D = -10\text{ A}, T_J = 125\text{ }^\circ\text{C}$			0.102	
		$V_{GS} = -10\text{ V}, I_D = -10\text{ A}, T_J = 150\text{ }^\circ\text{C}$			0.120	
		$V_{GS} = -4.5\text{ V}, I_D = -5\text{ A}$		0.062	0.070	
Forward Transconductance <sup>a</sup>	$g_{fs}$	$V_{DS} = -15\text{ V}, I_D = -10\text{ A}$		22		S
<b>Dynamic<sup>b</sup></b>						
Input Capacitance	$C_{iss}$	$V_{GS} = 0\text{ V}, V_{DS} = -25\text{ V}, f = 1\text{ MHz}$		1140	1710	$\text{pF}$
Output Capacitance	$C_{oss}$			130		
Reverse Transfer Capacitance	$C_{rss}$			90		
Total Gate Charge <sup>c</sup>	$Q_g$	$V_{DS} = -30\text{ V}, V_{GS} = -10\text{ V}, I_D = -10\text{ A}$		26	40	$\text{nC}$
Gate-Source Charge <sup>c</sup>	$Q_{gs}$			4.5		
Gate-Drain Charge <sup>c</sup>	$Q_{gd}$			7		
Gate Resistance	$R_g$	$f = 1\text{ MHz}$		7		$\Omega$
Turn-On Delay Time <sup>c</sup>	$t_{d(on)}$	$V_{DD} = -30\text{ V}, R_L = 3\text{ }\Omega$ $I_D \cong -19\text{ A}, V_{GEN} = -10\text{ V}, R_g = 2.5\text{ }\Omega$		8	15	ns
Rise Time <sup>c</sup>	$t_r$			9	15	
Turn-Off Delay Time <sup>c</sup>	$t_{d(off)}$			65	100	
Fall Time <sup>c</sup>	$t_f$			30	45	
<b>Drain-Source Body Diode and Characteristics</b> ( $T_C = 25\text{ }^\circ\text{C}$ ) <sup>b</sup>						
Continuous Current	$I_S$				- 30	A
Pulsed Current	$I_{SM}$				- 30	
Forward Voltage <sup>a</sup>	$V_{SD}$	$I_F = -19\text{ A}, V_{GS} = 0\text{ V}$		- 1	- 1.5	V
Reverse Recovery Time	$t_{rr}$	$I_F = -19\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		41	61	ns

Notes:

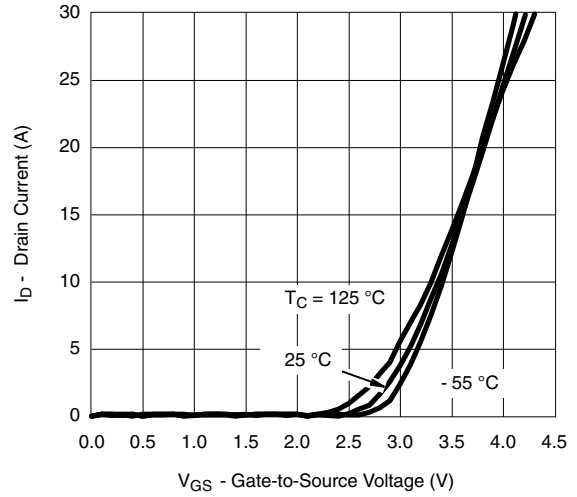
- Pulse test; pulse width  $\leq 300\text{ }\mu\text{s}$ , duty cycle  $\leq 2\%$ .
- Guaranteed by design, not subject to production testing.
- Independent of operating temperature.

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 otherwise noted)



**Output Characteristics**



**Transfer Characteristics**



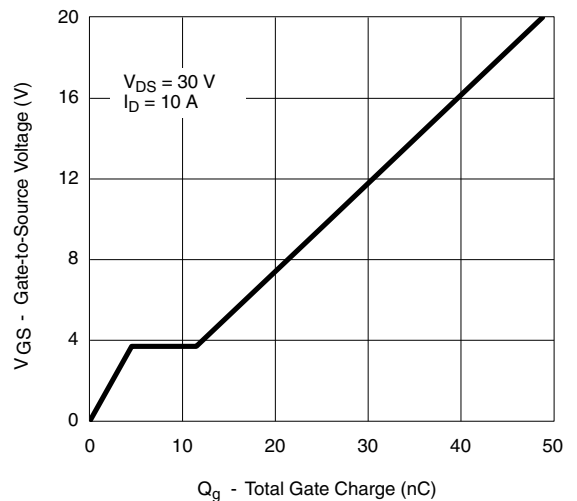
**Transconductance**



**On-Resistance vs. Drain Current**

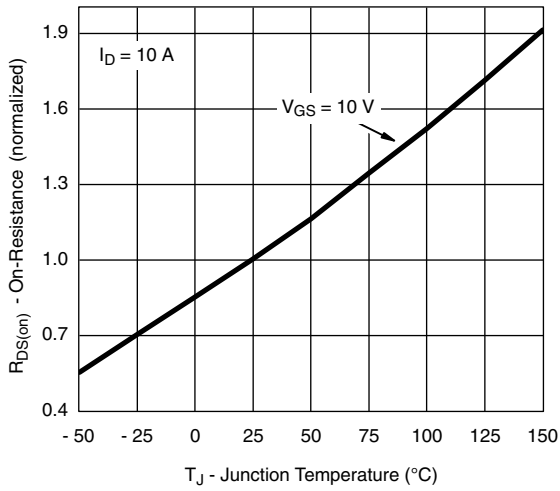


**Capacitance**



**Gate Charge**

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

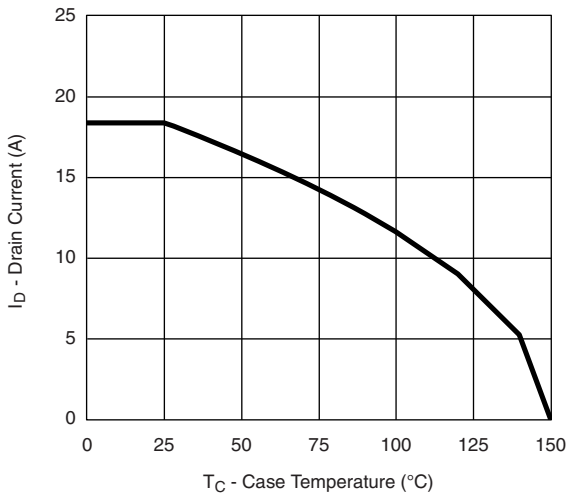


**On-Resistance vs. Junction Temperature**

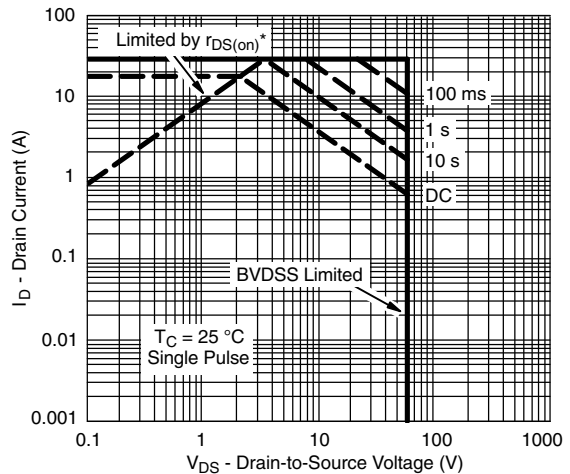


**Source-Drain Diode Forward Voltage**

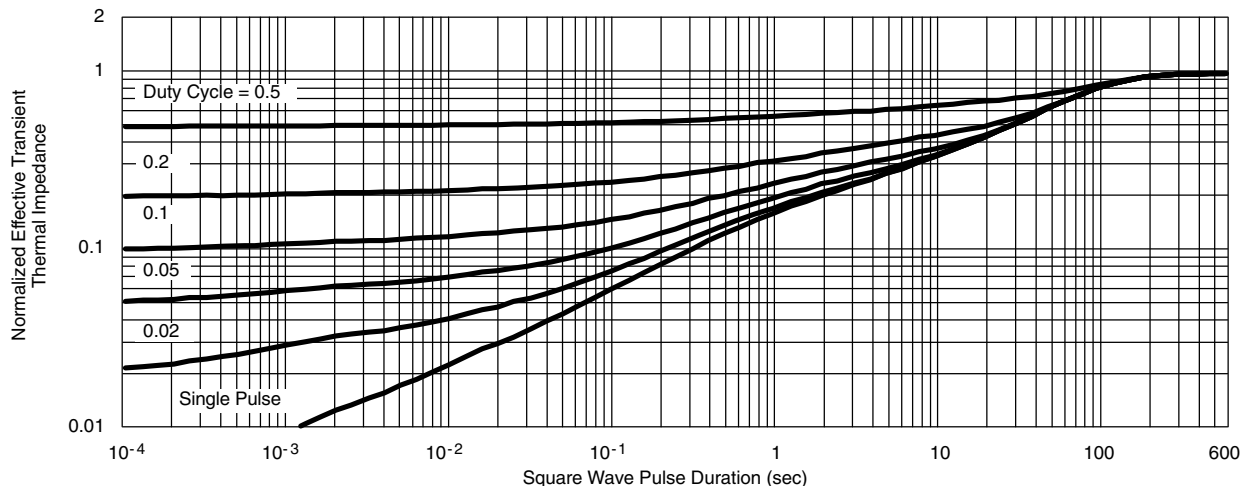
**THERMAL RATINGS**



**Maximum Drain Current vs. Case Temperature**

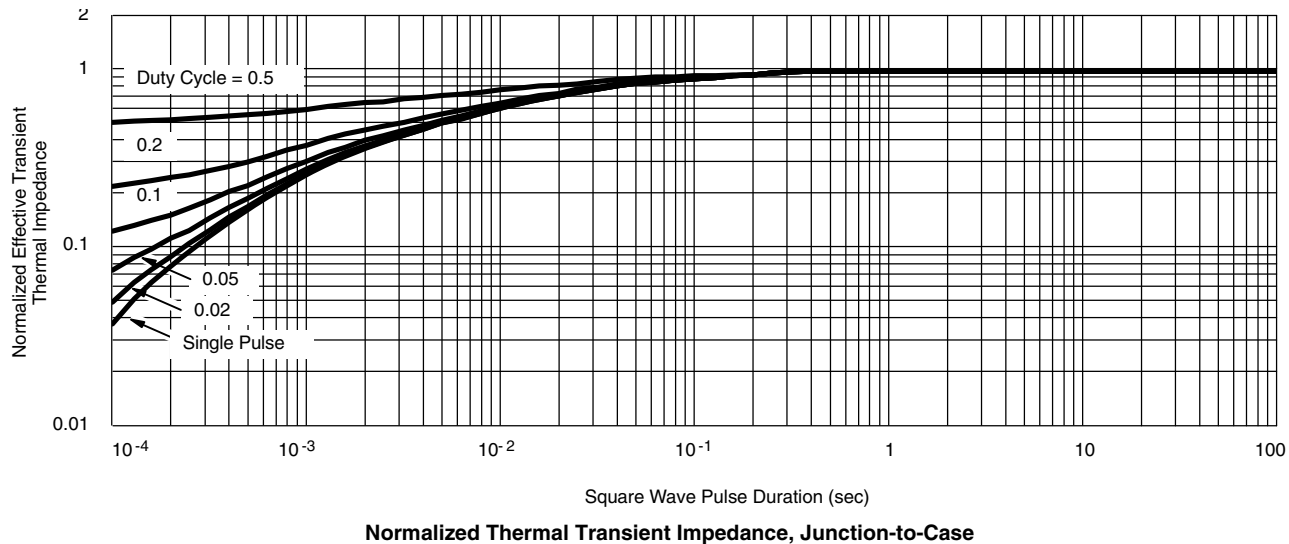


**Safe Operating Area**  
\*  $V_{GS} >$  minimum  $V_{GS}$  at which  $r_{DS(on)}$  is specified

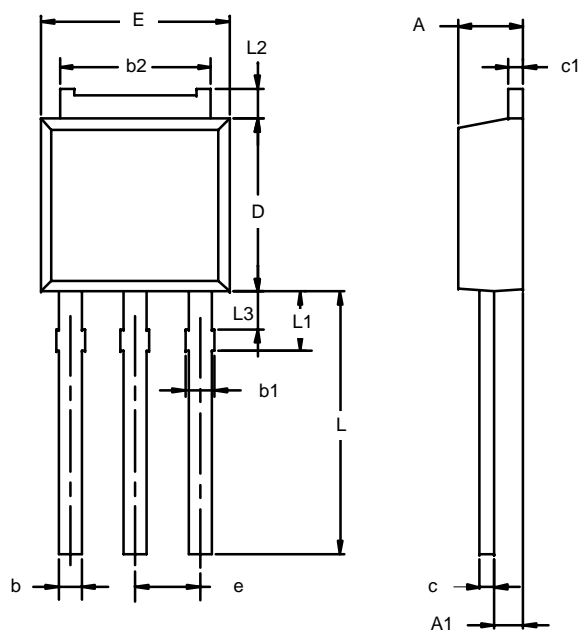


**Normalized Thermal Transient Impedance, Junction-to-Ambient**

### THERMAL RATINGS



**TO-251AA**



Note: Dimension L3 is for reference only.

Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	2.21	2.38	0.087	0.094
<b>A1</b>	0.89	1.14	0.035	0.045
<b>b</b>	0.71	0.89	0.028	0.035
<b>b1</b>	0.76	1.14	0.030	0.045
<b>b2</b>	5.23	5.43	0.206	0.214
<b>c</b>	0.46	0.58	0.018	0.023
<b>c1</b>	0.46	0.58	0.018	0.023
<b>D</b>	5.97	6.22	0.235	0.245
<b>E</b>	6.48	6.73	0.255	0.265
<b>e</b>	2.28 BSC		0.090 BSC	
<b>L</b>	3.89	9.53	0.153	0.375
<b>L1</b>	1.91	2.28	0.075	0.090
<b>L2</b>	0.89	1.27	0.035	0.050
<b>L3</b>	1.15	1.52	0.045	0.060

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DWG: 5346

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