

2N7218, JANTX2N7218, JANTXV2N7218  
 2N7219, JANTX2N7219, JANTXV2N7219

2N7221, JANTX2N7221, JANTXV2N7221  
 2N7222, JANTX2N7222, JANTXV2N7222

## JANTX, JANTXV POWER MOSFET IN TO-254AA PACKAGE, QUALIFIED TO MIL-PRF-19500/596

100V Thru 500V, Up to 28A, N-Channel,  
 MOSFET Power Transistor, Repetitive Avalanche Rated

### FEATURES

- Repetitive Avalanche Rating
- Isolated and Hermetically Sealed
- Low  $R_{DS(on)}$
- Ease of Paralleling
- Ceramic Feedthroughs
- Qualified to MIL-PRF-19500



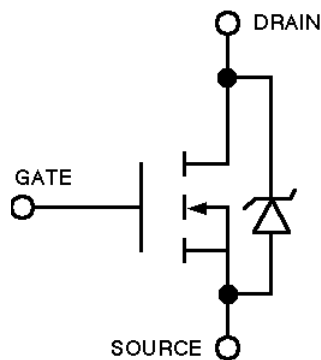
### DESCRIPTION

This hermetically packaged QPL product features the latest advanced MOSFET and packaging technology. It is ideally suited for Military requirements where small size, high performance and high reliability are required, and in applications such as switching power supplies, motor controls, inverters, choppers, audio amplifiers and high energy pulse circuits.

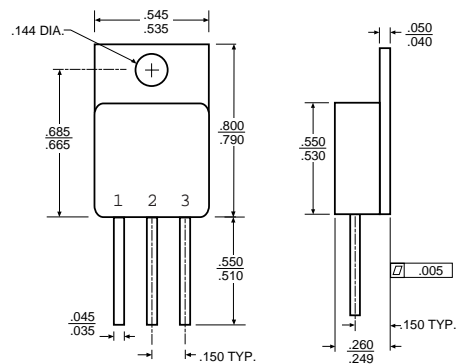
PRIMARY ELECTRICAL CHARACTERISTICS @  $T_c = 25\text{ C}$

PART NUMBER	$V_{DS}$ , Volts	$R_{DS(on)}$	$I_D$ , Amps
2N7218	100	.070	28
2N7219	200	.18	18
2N7221	400	.55	10
2N7222	500	.85	8

### SCHEMATIC



### MECHANICAL OUTLINE



Pin Connection  
 Pin 1: Drain  
 Pin 2: Source  
 Pin 3: Gate

2N7218, JAN1X2N7218, JAN1XV2N7218  
2N7219, JAN1X2N7219, JAN1XV2N7219

2N7221, JAN1X2N7221, JAN1XV2N7221  
2N7222, JAN1X2N7222, JAN1XV2N7222

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Parameter		JAN1XV, JAN1X, 2N7218	Units
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 25^\circ\text{C}$	Continuous Drain Current	28	A
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 100^\circ\text{C}$	Continuous Drain Current	20	A
$I_{DM}$	Pulsed Drain Current <sup>1</sup>	112	A
$P_D$ @ $T_C = 25^\circ\text{C}$	Maximum Power Dissipation	125	W
	Linear Derating Factor	1.0	W/ $^\circ\text{C}$
$V_{GS}$	Gate-Source Voltage	$\pm 20$	V
$E_{AS}$	Single Pulse Avalanche Energy <sup>2</sup>	250 <sup>4</sup>	mJ
$I_{AR}$	Avalanche Current <sup>1</sup>	28 <sup>4</sup>	A
$E_{ARR}$	Repetitive Avalanche Energy <sup>1</sup>	12.5 <sup>4</sup>	mJ
$T_J$	Operating Junction	-55 to 150	$^\circ\text{C}$
$T_{STG}$	Storage Temperature Range		$^\circ\text{C}$
	Lead Temperature	300(.06 from case for 10 sec)	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS @  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-Source Breakdown Voltage	100			V	$V_{GS} = 0\text{V}$ , $I_D = 1.0\text{ mA}$ ,
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.077		$V_{GS} = 10\text{V}$ , $I_D = 20\text{ A}$ <sup>3</sup>
	—	—	0.125		$V_{GS} = 10\text{V}$ , $I_D = 28\text{ A}$ <sup>3</sup>
$V_{GS(th)}$ Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$
$I_{DSS}$ Zero Gate Voltage Drain Current	—	—	25	$\mu\text{A}$	$V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{V}$
	—	—	250		$V_{DS} = 80\text{ V}$ , $V_{GS} = 0\text{V}$ , $T_J = 125^\circ\text{C}$
$I_{SS}$ Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
$I_{SS}$ Gate -to-Source Leakage Reverse	—	—	-100	nA	$V_{GS} = -20\text{ V}$
$Q_{G(on)}$ On-state Gate Charge	—	—	59	nC	$V_{GS} = 10\text{ V}$ , $I_D = 28\text{A}$
$Q_{GS}$ Gate-to-Source Charge	—	—	16	nC	$V_{DS} = 50\text{ V}$
$Q_{GD}$ Gate-to-Drain ("Miller") Charge	—	—	30.7	nC	See note 4
$t_{ON}$ Turn-On Delay Time	—	—	21	ns	$V_{DD} = 50\text{ V}$ , $I_D = 20\text{A}$ , $R_G = 9.1$
$t_r$ Rise Time	—	—	105	ns	See note 4
$t_{OFF}$ Turn-Off Delay Time	—	—	64	ns	
$t_f$ Fall Time	—	—	65	ns	

Source-Drain Diode Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{SD}$ Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$ , $I_S = 28\text{A}$ <sup>3</sup> , $V_{GS} = 0\text{ V}$
$t_r$ Reverse Recovery Time	—	—	400	ns	$T_J = 25^\circ\text{C}$ , $I_F = 28\text{A}$ , $di/dt \leq 100\text{A}/\mu\text{s}$ <sup>3</sup>

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{thJC}$ Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$	Mounting surface flat, smooth, and greased
$R_{thCS}$ Case-to-sink	—	0.21	—		
$R_{thJA}$ Junction-to-Ambient	—	—	48		

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @  $V_{DD} = 25\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  $L \geq 480\text{ }\mu\text{H}$ ,  $R_G = 25$ , Peak  $I_L = 28\text{A}$
3. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$
4. See MIL-S-19500/596

2N7218, JANTX2N7218, JANTXV2N7218  
2N7219, JANTX2N7219, JANTXV2N7219

2N7221, JANTX2N7221, JANTXV2N7221  
2N7222, JANTX2N7222, JANTXV2N7222

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Parameter	JANTXV, JANTX, 2N7219	Units
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 25^\circ\text{C}$ Continuous Drain Current	18	A
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 100^\circ\text{C}$ Continuous Drain Current	11	A
$I_{DM}$ Pulsed Drain Current <sup>1</sup>	72	A
$P_D$ @ $T_C = 25^\circ\text{C}$ Maximum Power Dissipation	125	W
Linear Derating Factor	1.0	W/ $^\circ\text{C}$
$V_{GS}$ Gate-Source Voltage	$\pm 20$	V
$E_{AS}$ Single Pulse Avalanche Energy <sup>2</sup>	450 <sup>4</sup>	mJ
$I_{AR}$ Avalanche Current <sup>1</sup>	18 <sup>4</sup>	A
$E_{AR}$ Repetitive Avalanche Energy <sup>1</sup>	12.5 <sup>4</sup>	mJ
$T_J$ Operating Junction	-55 to 150	$^\circ\text{C}$
$T_{STG}$ Storage Temperature Range		$^\circ\text{C}$
Lead Temperature	300(.06 from case for 10 sec)	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS @  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-Source Breakdown Voltage	200			V	$V_{GS} = 0\text{V}$ , $I_D = 1.0\text{ mA}$ ,
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.18		$V_{GS} = 10\text{V}$ , $I_D = 11\text{ A}$ <sup>3</sup>
	—	—	0.25		$V_{GS} = 10\text{V}$ , $I_D = 18\text{ A}$ <sup>3</sup>
$V_{GS(th)}$ Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$
$I_{SS}$ Zero Gate Voltage Drain Current	—	—	25	$\mu\text{A}$	$V_{DS} = 160\text{ V}$ , $V_{GS} = 0\text{V}$
	—	—	250		$V_{DS} = 160\text{ V}$ , $V_{GS} = 0\text{V}$ , $T_J = 125^\circ\text{C}$
$I_{SS}$ Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
$I_{SS}$ Gate -to-Source Leakage Reverse	—	—	-100	nA	$V_{GS} = -20\text{ V}$
$Q_{G(on)}$ On-state Gate Charge	—	—	60	nC	$V_{GS} = 10\text{ V}$ , $I_D = 18\text{A}$
$Q_{GS}$ Gate-to-Source Charge	—	—	10.6	nC	$V_{DS} = 100\text{ V}$
$Q_{GD}$ Gate-to-Drain ("Miller") Charge	—	—	37.6	nC	See note 4
$t_{(on)}$ Turn-On Delay Time	—	—	20	ns	$V_{DD} = 100\text{ V}$ , $I_D = 11\text{A}$ , $R_G = 9.1$
$t_r$ Rise Time	—	—	105	ns	See note 4
$t_{(off)}$ Turn-Off Delay Time	—	—	58	ns	
$t_f$ Fall Time	—	—	67	ns	

Source-Drain Diode Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{SD}$ Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$ , $I_S = 18\text{ A}$ <sup>3</sup> , $V_{GS} = 0\text{ V}$
$t_r$ Reverse Recovery Time	—	—	500	ns	$T_J = 25^\circ\text{C}$ , $I_F = 18\text{A}$ , $di/dt < 100\text{A}/\mu\text{s}$ <sup>3</sup>

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{thJC}$ Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$	Mounting surface flat, smooth, and greased
$R_{thCS}$ Case-to-sink	—	0.21	—		
$R_{thJA}$ Junction-to-Ambient	—	—	48		

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @  $V_{DD} = 50\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  $L \geq 2.1\text{ mH}$ ,  $R_G = 25$ , Peak  $I_D = 18\text{A}$
3. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$
4. See MIL-S-19500/596

2N7218, JANTX2N7218, JANTXV2N7218  
2N7219, JANTX2N7219, JANTXV2N7219

2N7221, JANTX2N7221, JANTXV2N7221  
2N7222, JANTX2N7222, JANTXV2N7222

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Parameter	JANTXV, JANTX, 2N7221	Units
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 25^\circ\text{C}$ Continuous Drain Current	10	A
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 100^\circ\text{C}$ Continuous Drain Current	6.0	A
$I_{DM}$ Pulsed Drain Current <sup>1</sup>	40	A
$P_D$ @ $T_C = 25^\circ\text{C}$ Maximum Power Dissipation	125	W
Linear Derating Factor	1.0	W/ $^\circ\text{C}$
$V_{GS}$ Gate-Source Voltage	$\pm 20$	V
$E_{AS}$ Single Pulse Avalanche Energy <sup>2</sup>	650 <sup>4</sup>	mJ
$I_{AR}$ Avalanche Current <sup>1</sup>	10 <sup>4</sup>	A
$E_{ARR}$ Repetitive Avalanche Energy <sup>1</sup>	12.5 <sup>4</sup>	mJ
$T_J$ Operating Junction	-55 to 150	$^\circ\text{C}$
$T_{STG}$ Storage Temperature Range		$^\circ\text{C}$
Lead Temperature	300 (.06 from case for 10 sec)	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS @  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-Source Breakdown Voltage	400			V	$V_{GS} = 0\text{V}$ , $I_D = 1.0\text{ mA}$ ,
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.55		$V_{GS} = 10\text{ V}$ , $I_D = 6.0\text{ A}$ <sup>3</sup>
	—	—	0.70		$V_{GS} = 10\text{ V}$ , $I_D = 10\text{ A}$ <sup>3</sup>
$V_{GS(th)}$ Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$
$I_{DSS}$ Zero Gate Voltage Drain Current	—	—	25	$\mu\text{A}$	$V_{DS} = 320\text{ V}$ , $V_{GS} = 0\text{V}$
	—	—	250		$V_{DS} = 320\text{ V}$ , $V_{GS} = 0\text{V}$ , $T_J = 125^\circ\text{C}$
$I_{SS}$ Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
$I_{SS}$ Gate -to-Source Leakage Reverse	—	—	-100	nA	$V_{GS} = -20\text{ V}$
$Q_{G(on)}$ On-state Gate Charge	—	—	65	nC	$V_{GS} = 10\text{ V}$ , $I_D = 10\text{ A}$
$Q_{GS}$ Gate-to-Source Charge	—	—	10	nC	$V_{DS} = 200\text{ V}$
$Q_{GD}$ Gate-to-Drain ("Miller") Charge	—	—	40.5	nC	See note 4
$t_{ON}$ Turn-On Delay Time	—	—	25	ns	$V_{DD} = 200\text{ V}$ , $I_D = 6\text{ A}$ , $R_G = 9.1$
$t_r$ Rise Time	—	—	92	ns	See note 4
$t_{OFF}$ Turn-Off Delay Time	—	—	79	ns	
$t_f$ Fall Time	—	—	58	ns	

Source-Drain Diode Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{SD}$ Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$ , $I_S = 10\text{ A}$ <sup>3</sup> , $V_{GS} = 0\text{ V}$
$t_r$ Reverse Recovery Time	—	—	600	ns	$T_J = 25^\circ\text{C}$ , $I_S = 10\text{ A}$ , $di/dt < 100\text{ A}/\mu\text{s}$ <sup>3</sup>

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{thJC}$ Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$	Mounting surface flat, smooth, and greased
$R_{thCS}$ Case-to-sink	—	0.21	—		
$R_{thJA}$ Junction-to-Ambient	—	—	48		

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @  $V_{DD} = 50\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  $L \geq 11.4\text{ mH}$ ,  $R_G = 25$ , Peak  $I_L = 10\text{ A}$
3. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$
4. See MIL-S-19500/596

2N7218, JAN1X2N7218, JAN1XV2N7218  
2N7219, JAN1X2N7219, JAN1XV2N7219

2N7221, JAN1X2N7221, JAN1XV2N7221  
2N7222, JAN1X2N7222, JAN1XV2N7222

ABSOLUTE MAXIMUM RATINGS ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Parameter	JAN1XV, JAN1X, 2N7222	Units
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 25^\circ\text{C}$ Continuous Drain Current	8.0	A
$I_D$ @ $V_{GS} = 10\text{V}$ , $T_C = 100^\circ\text{C}$ Continuous Drain Current	5.0	A
$I_{DM}$ Pulsed Drain Current <sup>1</sup>	32	A
$P_D$ @ $T_C = 25^\circ\text{C}$ Maximum Power Dissipation	125	W
Linear Derating Factor	1.0	W/ $^\circ\text{C}$
$V_{GS}$ Gate-Source Voltage	$\pm 20$	V
$E_{AS}$ Single Pulse Avalanche Energy <sup>2</sup>	700 <sup>4</sup>	mJ
$I_{AR}$ Avalanche Current <sup>1</sup>	8.0 <sup>4</sup>	A
$E_{ARR}$ Repetitive Avalanche Energy <sup>1</sup>	12.5 <sup>4</sup>	mJ
$T_J$ Operating Junction	-55 to 150	$^\circ\text{C}$
$T_{STG}$ Storage Temperature Range		$^\circ\text{C}$
Lead Temperature	300(.06 from case for 10 sec)	$^\circ\text{C}$

ELECTRICAL CHARACTERISTICS @  $T_J = 25^\circ\text{C}$  (Unless Otherwise Specified)

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$BV_{DSS}$ Drain-Source Breakdown Voltage	500			V	$V_{GS} = 0\text{V}$ , $I_D = 1.0\text{ mA}$ ,
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.85		$V_{GS} = 10\text{V}$ , $I_D = 5.0\text{ A}$ <sup>3</sup>
	—	—	0.95		$V_{GS} = 10\text{V}$ , $I_D = 8.0\text{ A}$ <sup>3</sup>
$V_{GS(th)}$ Gate Threshold Voltage	2.0	—	4.0	V	$V_{DS} = V_{GS}$ , $I_D = 250\text{ }\mu\text{A}$
$I_{DSS}$ Zero Gate Voltage Drain Current	—	—	25	$\mu\text{A}$	$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{V}$
	—	—	250		$V_{DS} = 400\text{ V}$ , $V_{GS} = 0\text{V}$ , $T_J = 125^\circ\text{C}$
$I_{SS}$ Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
$I_{SS}$ Gate -to-Source Leakage Reverse	—	—	-100	nA	$V_{GS} = -20\text{ V}$
$Q_{G(on)}$ On-state Gate Charge	—	—	68.5	nC	$V_{GS} = 10\text{ V}$ , $I_D = 8.0\text{ A}$
$Q_{GS}$ Gate-to-Source Charge	—	—	12.5	nC	$V_{DS} = 250\text{ V}$
$Q_{GD}$ Gate-to-Drain ("Miller") Charge	—	—	42.4	nC	See note 4
$t_{b(on)}$ Turn-On Delay Time	—	—	21	ns	$V_{DD} = 250\text{ V}$ , $I_D = 5.0\text{ A}$ , $R_G = 9.1$ See note 4
$t_r$ Rise Time	—	—	73	ns	
$t_{b(off)}$ Turn-Off Delay Time	—	—	72	ns	
$t_f$ Fall Time	—	—	51	ns	

Source-Drain Diode Ratings and Characteristics

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$V_{SD}$ Diode Forward Voltage	—	—	1.5	V	$T_J = 25^\circ\text{C}$ , $I_S = 8.0\text{ A}$ <sup>3</sup> , $V_{GS} = 0\text{ V}$
$t_r$ Reverse Recovery Time	—	—	700	ns	$T_J = 25^\circ\text{C}$ , $I_R = 8.0\text{ A}$ , $dI/dt < 100\text{ A}/\mu\text{s}$ <sup>3</sup>

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{thJC}$ Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$	Mounting surface flat, smooth, and greased
$R_{thCS}$ Case-to-sink	—	0.21	—		
$R_{thJA}$ Junction-to-Ambient	—	—	48		

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @  $V_{DD} = 50\text{V}$ , Starting  $T_J = 25^\circ\text{C}$ ,  $L \geq 20\text{ mH}$ ,  $R_G = 25$ , Peak  $I_L = 8\text{ A}$
3. Pulse width  $\leq 300\text{ }\mu\text{s}$ ; Duty Cycle  $\leq 2\%$
4. See MIL-S-19500/596