

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



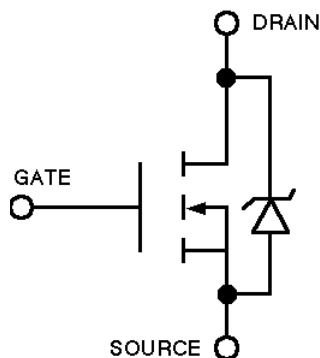
DESCRIPTION

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.

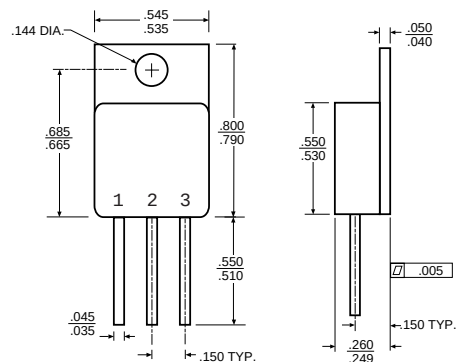
PRIMARY ELECTRICAL CHARACTERISTICS @ $T_c = 25^\circ\text{C}$

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, 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, 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 ¹	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	± 20	V
E_{AS} Single Pulse Avalanche Energy ²	250 ⁴	mJ
I_{AR} Avalanche Current ¹	28 ⁴	A
E_{ARR} Repetitive Avalanche Energy ⁴	12.5 ⁴	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	$V_{GS} = 0\text{V}$, $I_D \leq 1.0\text{ mA}$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.077		$V_{GS} = 10\text{V}$, $I_D = 20\text{ A}$ ³
	—	—	0.125		$V_{GS} = 10\text{V}$, $I_D = 28\text{ A}$ ³
$V_{GS(th)}$ 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	μA	$V_{DS} = 80\text{ V}$, $V_{GS} = 0\text{V}$
	—	—	250	μA	$V_{DS} = 80\text{ V}$, $V_{GS} = 0\text{V}$, $T_J = 125^\circ\text{C}$
I_{SSS} Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
I_{SSS} 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	$T_J = 25^\circ\text{C}$, $I_S = 28\text{A}$ ³ , $V_{GS} = 0\text{ V}$
t_r Reverse Recovery Time	—	—	400	ns	$T_J = 25^\circ\text{C}$, $I_F = 28\text{A}$, $di/dt \leq 100\text{A}/\mu\text{s}$ ³

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
R_{thJC} Junction-to-Case	—	—	1.0		Mounting surface flat, smooth, and greased Typical socket mount
R_{thCS} Case-to-sink	—	0.21	—	$^\circ\text{C}/\text{W}$	
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 ¹	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	± 20	V
E_{AS} Single Pulse Avalanche Energy ²	450 ⁴	mJ
I_{AR} Avalanche Current ¹	18 ⁴	A
E_{ARR} Repetitive Avalanche Energy ¹	12.5 ⁴	mJ
T_J Operating Junction	-55 to 150	$^\circ\text{C}$
T_{STG} Storage Temperature Range		
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		$V_{GS} = 10\text{V}$, $I_D = 11\text{ A}$ ³
	—	—	0.25		$V_{GS} = 10\text{V}$, $I_D = 18\text{ A}$ ³
$V_{GS(th)}$ 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	μA	$V_{DS} = 100\text{ V}$, $V_{GS} = 0\text{V}$
	—	—	250		$V_{DS} = 100\text{ V}$, $V_{GS} = 0\text{V}$, $T_J = 125^\circ\text{C}$
I_{SSS} Gate -to-Source Leakage Forward	—	—	100	nA	$V_{GS} = 20\text{ V}$
I_{SSS} 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
$t_{b(on)}$ Turn-On Delay Time	—	—	20	ns	$V_{DD} = 100\text{ V}$, $I_D = 11\text{ A}$, $R_\theta = 9.1$ See note 4
t_r Rise Time	—	—	105	ns	
$t_{b(off)}$ 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	$T_J = 25^\circ\text{C}$, $I_S = 18\text{ A}$ ³ , $V_{GS} = 0\text{ V}$
t_r Reverse Recovery Time	—	—	500	ns	$T_J = 25^\circ\text{C}$, $I_F = 18\text{ A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$ ³

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 Typical socket mount
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 $T_J = 25^\circ\text{C}$, $L \geq 21\text{ mH}$, $R_\theta = 25$, Peak $I_L = 18\text{ A}$
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 ¹	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	± 20	V
E_{AS} Single Pulse Avalanche Energy ²	650 ⁴	mJ
I_{AR} Avalanche Current ¹	10 ⁴	A
E_{ARR} Repetitive Avalanche Energy ¹	12.5 ⁴	mJ
T_J Operating Junction	-55 to 150	$^\circ\text{C}$
T_{STG} Storage Temperature Range		
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	$V_{GS} = 0\text{V}$, $I_D \approx 1.0\text{ mA}$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.55		$V_{GS} = 10\text{ V}$, $I_D = 6.0\text{ A}$ ³
	—	—	0.70		$V_{GS} = 10\text{ V}$, $I_D = 10\text{ A}$ ³
$V_{GS(th)}$ 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	μA	$V_{DS} = 320\text{ V}$, $V_{GS} = 0\text{V}$
	—	—	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	$V_{DD} = 200\text{ V}$, $I_D = 6\text{ A}$, $R_G = 9.1$ See note 4
t_r Rise Time	—	—	92	ns	
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	$T_J = 25^\circ\text{C}$, $I_S = 10\text{ A}$ ³ , $V_{GS} = 0\text{ V}$
t_r Reverse Recovery Time	—	—	600	ns	$T_J = 25^\circ\text{C}$, $I_F = 10\text{ A}$, $di/dt < 100\text{ A}/\mu\text{s}$ ³

Thermal Resistance

Parameter	Min.	Typ.	Max.	Units	Test Conditions
$R_{\theta JC}$ Junction-to-Case	—	—	1.0	$^\circ\text{C}/\text{W}$	Mounting surface flat, smooth, and greased
$R_{\theta CS}$ Case-to-sink	—	0.21	—		
$R_{\theta JA}$ Junction-to-Ambient	—	—	48		Typical socket mount

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, 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, 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 ¹	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	± 20	V
E_{AS} Single Pulse Avalanche Energy ²	700 ⁴	mJ
I_{AR} Avalanche Current ¹	8.0 ⁴	A
E_{ARR} Repetitive Avalanche Energy ¹	12.5 ⁴	mJ
T_J Operating Junction	-55 to 150	$^\circ\text{C}$
T_{STG} Storage Temperature Range		
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	$V_{GS} = 0\text{V}$, $I_D \approx 1.0\text{ mA}$
$R_{DS(on)}$ Static Drain-to-Source On-State Resistance	—	—	0.85		$V_{GS} = 10\text{V}$, $I_D = 5.0\text{ A}$ ³
	—	—	0.95		$V_{GS} = 10\text{V}$, $I_D = 8.0\text{ A}$ ³
$V_{GS(th)}$ 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		$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{V}$
	—	—	250	μA	$V_{DS} = 400\text{ V}$, $V_{GS} = 0\text{V}$, $T_J = 125^\circ\text{C}$
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	$V_{DD} = 250\text{ V}$, $I_D = 5.0\text{A}$, $R_\theta = 9.1$ See note 4
t_r Rise Time	—	—	73	ns	
t_{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	$T_J = 25^\circ\text{C}$, $I_S = 8.0\text{ A}$ ³ , $V_{GS} = 0\text{ V}$
t_r Reverse Recovery Time	—	—	700	ns	$T_J = 25^\circ\text{C}$, $I_F = 8.0\text{A}$, $di/dt \leq 100\text{ A}/\mu\text{s}$ ³

Thermal Resistance

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

1. Repetitive Rating: Pulse width limited by maximum junction temperature.
2. @ $V_{DD} = 50\text{V}$, Starting $T_J = 25^\circ\text{C}$, $L \geq 20\text{ mH}$, $R_g = 25\text{ }\Omega$, 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