



## N-CHANNEL MOSFET

Qualified per MIL-PRF-19500/592

Qualified Levels:  
JAN, JANTX, and  
JANTXV

### DESCRIPTION

This family of switching transistors is military qualified up to the JANTXV level for high-reliability applications. These devices are also available in a low profile U surface mount package. Microsemi also offers numerous other transistor products to meet higher and lower power ratings with various switching speed requirements in both through-hole and surface-mount packages.

**Important:** For the latest information, visit our website <http://www.microsemi.com>.

### FEATURES

- JEDEC registered 2N7224, 2N7225, 2N7227 and 2N7228 number series.
- JAN, JANTX, and JANTXV qualifications are available per MIL-PRF-19500/592. (See [part nomenclature](#) for all available options.)
- RoHS compliant by design.

### APPLICATIONS / BENEFITS

- Low-profile design.
- Military and other high-reliability applications.

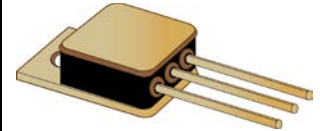
### MAXIMUM RATINGS @ T<sub>A</sub> = +25°C unless otherwise stated

Parameters / Test Conditions	Symbol	Value	Unit
Operating & Storage Junction Temperature Range	T <sub>J</sub> & T <sub>stg</sub>	-55 to +150	°C
Thermal Resistance Junction-to-Case	R <sub>θJC</sub>	0.83	°C/W
Total Power Dissipation	P <sub>T</sub>	4	W
		@ T <sub>A</sub> = +25 °C	
		@ T <sub>C</sub> = +25 °C <sup>(1)</sup>	
Gate-Source Voltage, dc	V <sub>GS</sub>	± 20	V
Drain Current, dc @ T <sub>C</sub> = +25 °C <sup>(2)</sup>	I <sub>D1</sub>	2N7224	34.0
		2N7225	27.4
		2N7227	14.0
		2N7228	12.0
Drain Current, dc @ T <sub>C</sub> = +100 °C <sup>(2)</sup>	I <sub>D2</sub>	2N7224	21
		2N7225	17
		2N7227	9
		2N7228	8
Off-State Current (Peak Total Value) <sup>(3)</sup>	I <sub>DM</sub>	2N7224	136
		2N7225	110
		2N7227	56
		2N7228	48
Source Current	I <sub>S</sub>	2N7224	34.0
		2N7225	27.4
		2N7227	14.0
		2N7228	12.0

- NOTES:**
1. Derated linearly by 1.2 W/°C for T<sub>C</sub> > +25 °C.
  2. The following formula derives the maximum theoretical ID limit. ID is limited by package and internal wires and may also be limited by pin diameter:


$$I_D = \sqrt{\frac{T_J(\text{max}) - T_C}{R_{\theta JC} \times R_{DS(on)} @ T_J(\text{max})}}$$

3. I<sub>DM</sub> = 4 x I<sub>D1</sub> as calculated in note 2.



**TO-254AA Package**

Also available in:

**U (SMD-1 or TO-267AB) package**  
(surface mount)  
 [2N7224U & 2N7228U](#)

#### MSC – Lawrence

6 Lake Street,  
Lawrence, MA 01841  
Tel: 1-800-446-1158 or  
(978) 620-2600  
Fax: (978) 689-0803

#### MSC – Ireland

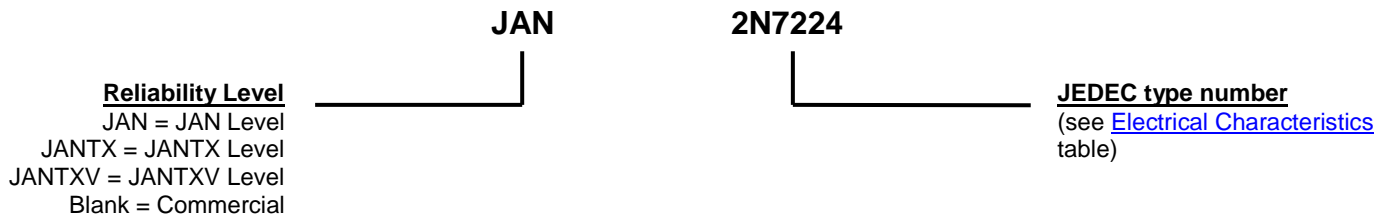
Gort Road Business Park,  
Ennis, Co. Clare, Ireland  
Tel: +353 (0) 65 6840044  
Fax: +353 (0) 65 6822298

**Website:**

[www.microsemi.com](http://www.microsemi.com)

**MECHANICAL and PACKAGING**

- CASE: Ceramic and gold over nickel plated steel.
- TERMINALS: Gold over nickel plated tungsten/copper.
- MARKING: Part number, date code, and polarity symbol.
- WEIGHT: 6.5 grams.
- See [Package Dimensions](#) on last page.

**PART NOMENCLATURE**

**SYMBOLS & DEFINITIONS**

Symbol	Definition
$di/dt$	Rate of change of diode current while in reverse-recovery mode, recorded as maximum value.
$I_F$	Forward current
$R_G$	Gate drive impedance
$V_{DD}$	Drain supply voltage
$V_{DS}$	Drain source voltage, dc
$V_{GS}$	Gate source voltage, dc

**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>OFF CHARACTERISTICS</b>				
Drain-Source Breakdown Voltage $V_{GS} = 0\text{ V}$ , $I_D = 1.0\text{ mA}$	2N7224 2N7225 2N7227 2N7228 $V_{(BR)DSS}$	100 200 400 500		V
Gate-Source Voltage (Threshold) $V_{DS} \geq V_{GS}$ , $I_D = 0.25\text{ mA}$ $V_{DS} \geq V_{GS}$ , $I_D = 0.25\text{ mA}$ , $T_J = +125\text{ }^\circ\text{C}$ $V_{DS} \geq V_{GS}$ , $I_D = 0.25\text{ mA}$ , $T_J = -55\text{ }^\circ\text{C}$	$V_{GS(th)1}$ $V_{GS(th)2}$ $V_{GS(th)3}$	2.0 1.0	4.0 5.0	V
Gate Current $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$ $V_{GS} = \pm 20\text{ V}$ , $V_{DS} = 0\text{ V}$ , $T_J = +125\text{ }^\circ\text{C}$	$I_{GSS1}$ $I_{GSS2}$		$\pm 100$ $\pm 200$	nA
Drain Current $V_{GS} = 0\text{ V}$ , $V_{DS} = 80\text{ V}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 160\text{ V}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 320\text{ V}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 400\text{ V}$	2N7224 2N7225 2N7227 2N7228 $I_{DSS1}$		25	$\mu\text{A}$
Drain Current $V_{GS} = 0\text{ V}$ , $V_{DS} = 80\text{ V}$ , $T_J = +125\text{ }^\circ\text{C}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 160\text{ V}$ , $T_J = +125\text{ }^\circ\text{C}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 320\text{ V}$ , $T_J = +125\text{ }^\circ\text{C}$ $V_{GS} = 0\text{ V}$ , $V_{DS} = 400\text{ V}$ , $T_J = +125\text{ }^\circ\text{C}$	2N7224 2N7225 2N7227 2N7228 $I_{DSS2}$		0.25	mA
Static Drain-Source On-State Resistance $V_{GS} = 10\text{ V}$ , $I_D = 21.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 17.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 9.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 8.0\text{ A}$ pulsed	2N7224 2N7225 2N7227 2N7228 $r_{DS(on)1}$		0.070 0.100 0.315 0.415	$\Omega$
Static Drain-Source On-State Resistance $V_{GS} = 10\text{ V}$ , $I_D = 34.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 27.4\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 14.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 12.0\text{ A}$ pulsed	2N7224 2N7225 2N7227 2N7228 $r_{DS(on)2}$		0.081 0.105 0.415 0.515	$\Omega$
Static Drain-Source On-State Resistance $T_J = +125\text{ }^\circ\text{C}$ $V_{GS} = 10\text{ V}$ , $I_D = 21.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 17.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 9.0\text{ A}$ pulsed $V_{GS} = 10\text{ V}$ , $I_D = 8.0\text{ A}$ pulsed	2N7224 2N7225 2N7227 2N7228 $r_{DS(on)3}$		0.11 0.17 0.68 0.90	$\Omega$
Diode Forward Voltage $V_{GS} = 0\text{ V}$ , $I_D = 34.0\text{ A}$ pulsed $V_{GS} = 0\text{ V}$ , $I_D = 27.4\text{ A}$ pulsed $V_{GS} = 0\text{ V}$ , $I_D = 14.0\text{ A}$ pulsed $V_{GS} = 0\text{ V}$ , $I_D = 12.0\text{ A}$ pulsed	2N7224 2N7225 2N7227 2N7228 $V_{SD}$		1.8 1.9 1.7 1.7	V

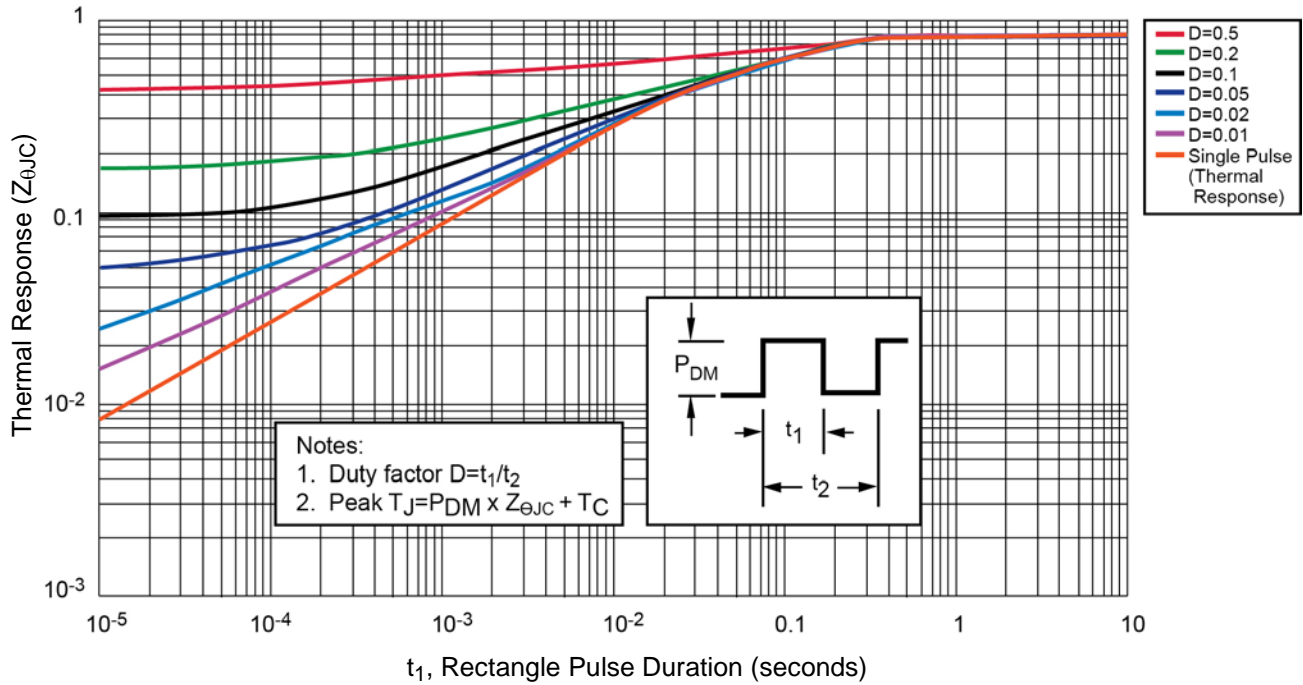
**ELECTRICAL CHARACTERISTICS @  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted (continued)**
**DYNAMIC CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>Gate Charge:</b>				
<b>On-State Gate Charge</b>				
$V_{GS} = 10\text{ V}$ , $I_D = 34.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7224	$Q_{g(on)}$		125	nC
$V_{GS} = 10\text{ V}$ , $I_D = 27.4\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7225			115	
$V_{GS} = 10\text{ V}$ , $I_D = 14.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7227			110	
$V_{GS} = 10\text{ V}$ , $I_D = 12.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7228			120	
<b>Gate to Source Charge</b>				
$V_{GS} = 10\text{ V}$ , $I_D = 34.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7224	$Q_{gs}$		22	nC
$V_{GS} = 10\text{ V}$ , $I_D = 27.4\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7225			22	
$V_{GS} = 10\text{ V}$ , $I_D = 14.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7227			18	
$V_{GS} = 10\text{ V}$ , $I_D = 12.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7228			19	
<b>Gate to Drain Charge</b>				
$V_{GS} = 10\text{ V}$ , $I_D = 34.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7224	$Q_{gd}$		65	nC
$V_{GS} = 10\text{ V}$ , $I_D = 27.4\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7225			60	
$V_{GS} = 10\text{ V}$ , $I_D = 14.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7227			65	
$V_{GS} = 10\text{ V}$ , $I_D = 12.0\text{ A}$ , $V_{DS} = 50\text{ V}$ 2N7228			70	

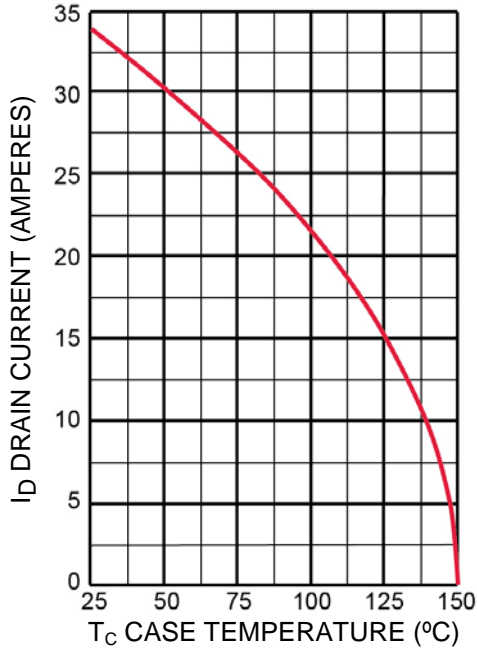
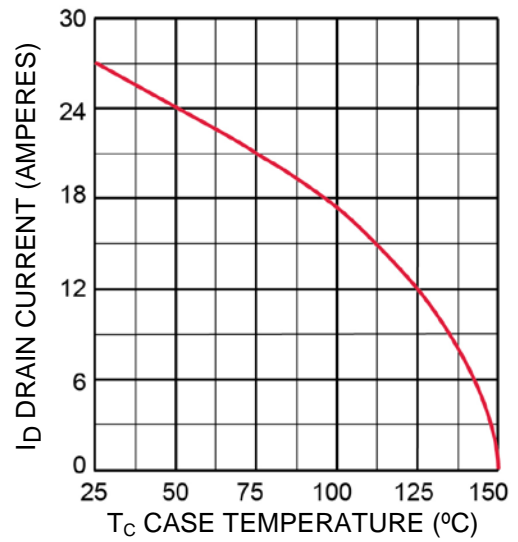
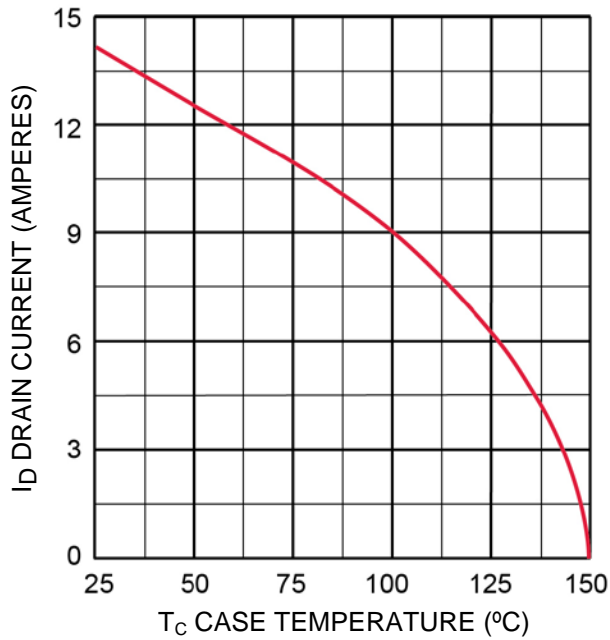
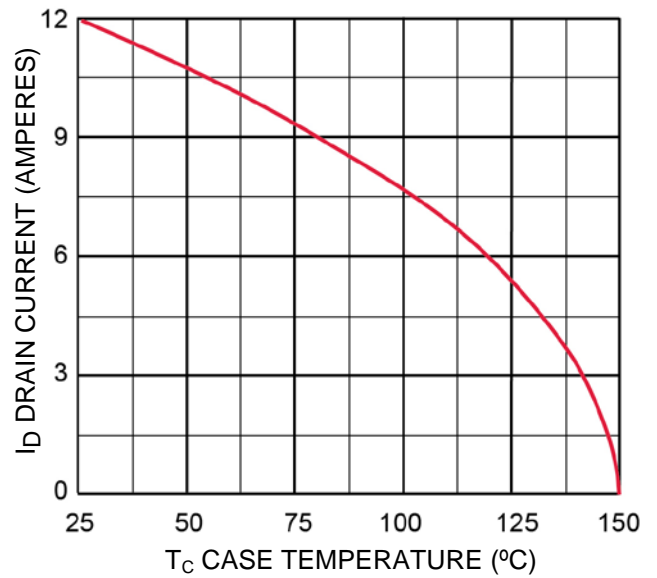
**SWITCHING CHARACTERISTICS**

Parameters / Test Conditions	Symbol	Min.	Max.	Unit
<b>Turn-on delay time</b>				
$I_D = 34.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 50\text{ V}$ 2N7224	$t_{d(on)}$		35	ns
$I_D = 27.4\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 250\text{ V}$ 2N7228				
<b>Rinse time</b>				
$I_D = 34.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 50\text{ V}$ 2N7224	$t_r$		190	ns
$I_D = 27.4\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 250\text{ V}$ 2N7228				
<b>Turn-off delay time</b>				
$I_D = 34.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 50\text{ V}$ 2N7224	$t_{d(off)}$		170	ns
$I_D = 27.4\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 250\text{ V}$ 2N7228				
<b>Fall time</b>				
$I_D = 34.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 50\text{ V}$ 2N7224	$t_f$		130	ns
$I_D = 27.4\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$ , $V_{GS} = 10\text{ V}$ , $R_G = 2.35\ \Omega$ , $V_{DD} = 250\text{ V}$ 2N7228				
<b>Diode Reverse Recovery Time</b>				
$di/dt \leq 100\text{ A}/\mu\text{s}$ , $V_{DD} \leq 30\text{ V}$ , $I_F = 34.0\text{ A}$ 2N7224	$t_{rr}$		500	ns
$di/dt \leq 100\text{ A}/\mu\text{s}$ , $V_{DD} \leq 30\text{ V}$ , $I_F = 27.4\text{ A}$ 2N7225			950	
$di/dt \leq 100\text{ A}/\mu\text{s}$ , $V_{DD} \leq 30\text{ V}$ , $I_F = 14.0\text{ A}$ 2N7227			1200	
$di/dt \leq 100\text{ A}/\mu\text{s}$ , $V_{DD} \leq 30\text{ V}$ , $I_F = 12.0\text{ A}$ 2N7228			1600	

GRAPHS

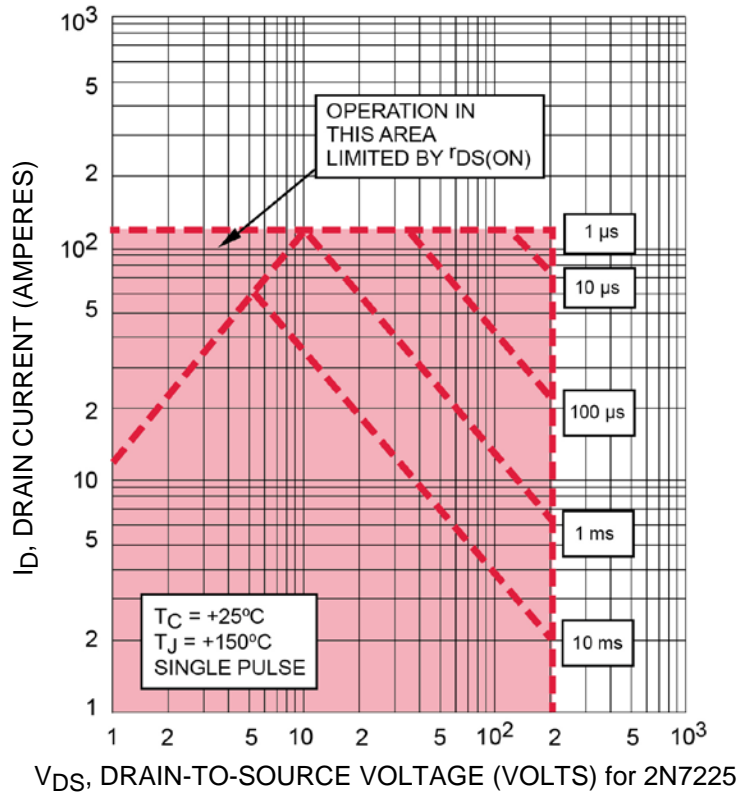
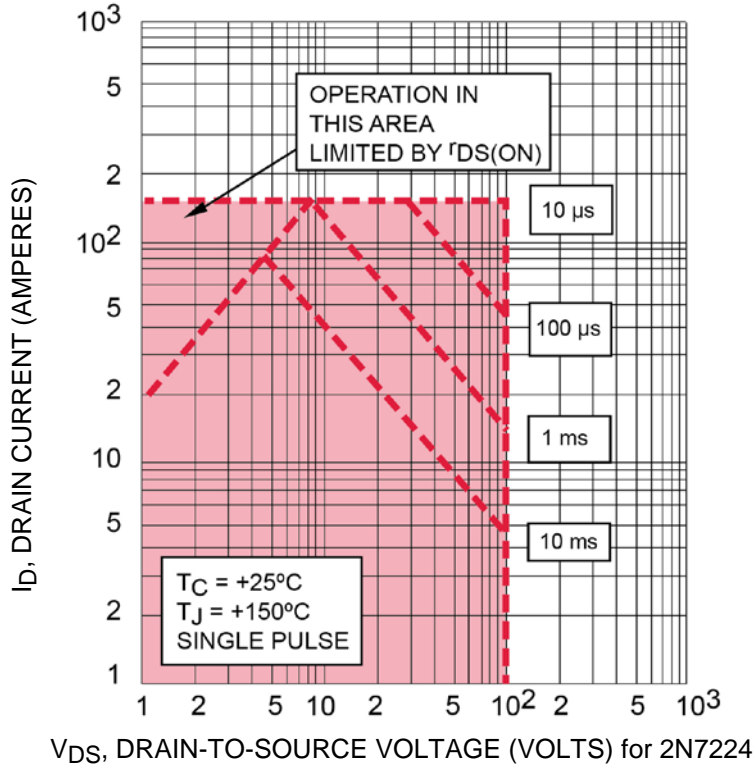


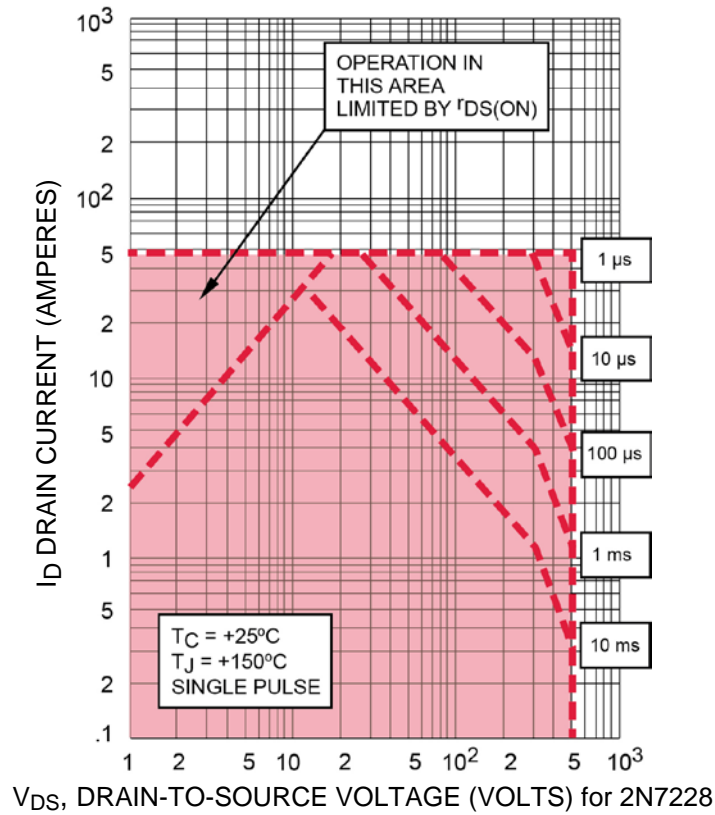
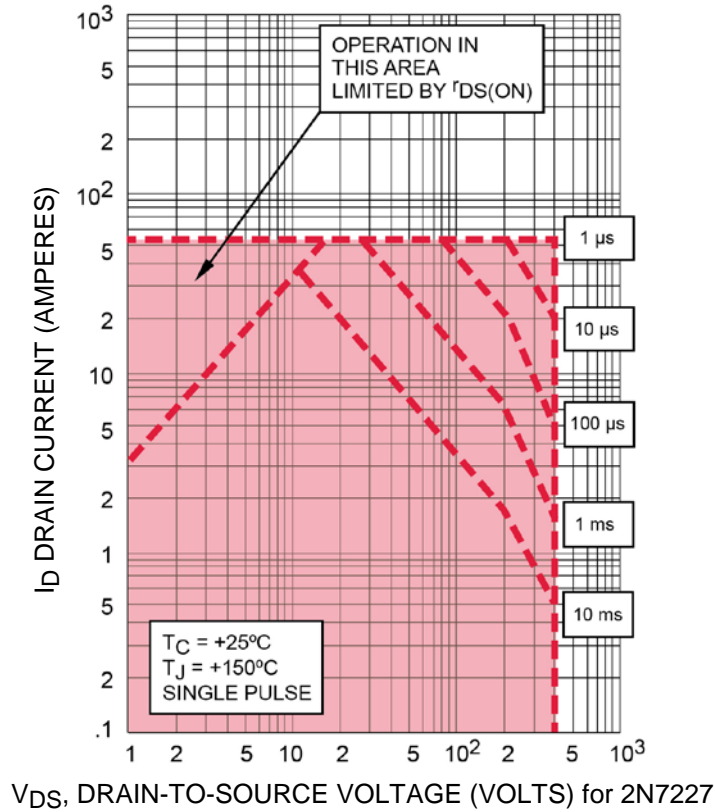
**FIGURE 1**  
Thermal Impedance Curves

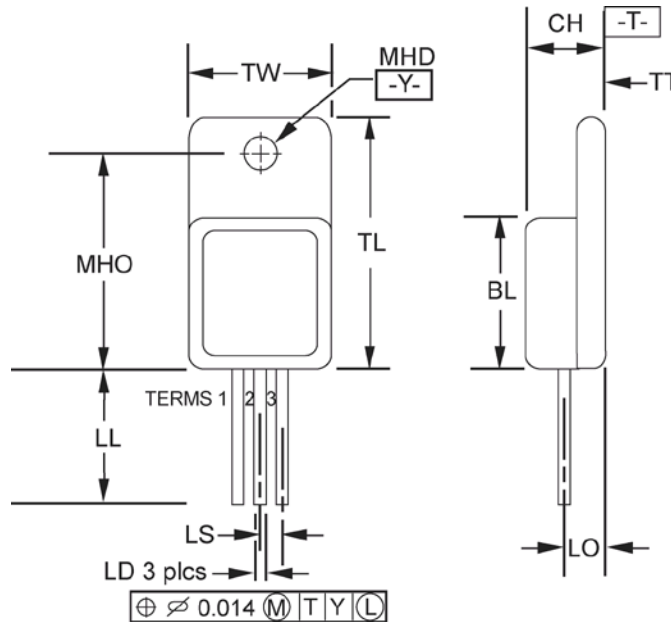
**GRAPHS (continued)**
**FIGURE 2 – Maximum Drain Current vs Case Temperature Graphs**

**For 2N7224**

**For 2N7225**

**For 2N7227**

**For 2N7228**

GRAPHS (continued)

FIGURE 3 – Maximum Safe Operating Area



**GRAPHS (continued)**


**PACKAGE DIMENSIONS**

**NOTES:**

1. Dimensions are in inches.
2. Millimeters are given for general information only.
3. Glass meniscus included in dimension D and E.
4. All terminals are isolated from case.
5. In accordance with ASME Y14.5M, diameters are equivalent to  $\Phi$ x symbology.

Ltr	Dimensions				Notes
	Inch		Millimeters		
	Min	Max	Min	Max	
<b>BL</b>	.535	.545	13.59	13.84	
<b>CH</b>	.249	.260	6.32	6.60	
<b>LD</b>	.035	.045	0.89	1.14	
<b>LL</b>	.510	.570	12.95	14.48	
<b>LO</b>	.150 BSC		3.81 BSC		
<b>LS</b>	.150 BSC		3.81 BSC		
<b>MHD</b>	.139	.149	3.53	3.78	
<b>MHO</b>	.665	.685	16.89	17.40	
<b>TL</b>	.790	.800	20.07	20.32	3, 4
<b>TT</b>	.040	.050	1.02	1.27	
<b>TW</b>	.535	.545	13.59	13.84	3, 4
<b>Term 1</b>	Drain				
<b>Term 2</b>	Source				
<b>Term 3</b>	Gate				

## Looking for pricing, stock, or lifecycle information?

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