



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.

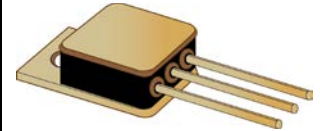
MAXIMUM RATINGS @ T_A = +25°C unless otherwise stated

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

- NOTES:**
1. Derated linearly by 1.2 W/°C for T_C > +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_{DM} = 4 x I_{D1} as calculated in note 2.



TO-254AA Package

Also available in:

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

MSC – Lawrence

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MSC – Ireland

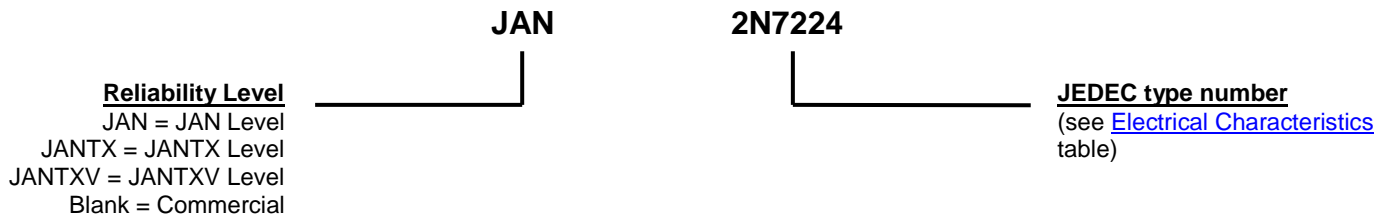
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www.microsemi.com

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
OFF CHARACTERISTICS				
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}		± 100 ± 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	μA
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	Ω
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	Ω
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	Ω
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
Gate Charge:				
On-State Gate Charge				
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 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	
Gate to Source Charge				
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 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	
Gate to Drain Charge				
$V_{GS} = 10\text{ V}$, $I_D = 34.0\text{ A}$, $V_{DS} = 50\text{ V}$ 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
Turn-on delay time				
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224	$t_{d(on)}$		35	ns
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228				
Rinse time				
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224	t_r		190	ns
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228				
Turn-off delay time				
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224	$t_{d(off)}$		170	ns
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228				
Fall time				
$I_D = 34.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 50\text{ V}$ 2N7224	t_f		130	ns
$I_D = 27.4\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 100\text{ V}$ 2N7225				
$I_D = 14.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 200\text{ V}$ 2N7227				
$I_D = 12.0\text{ A}$, $V_{GS} = 10\text{ V}$, $R_G = 2.35\text{ }\Omega$, $V_{DD} = 250\text{ V}$ 2N7228				
Diode Reverse Recovery Time				
$di/dt \leq 100\text{ A}/\mu\text{s}$, $V_{DD} \leq 30\text{ V}$, $I_F = 34.0\text{ A}$ 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

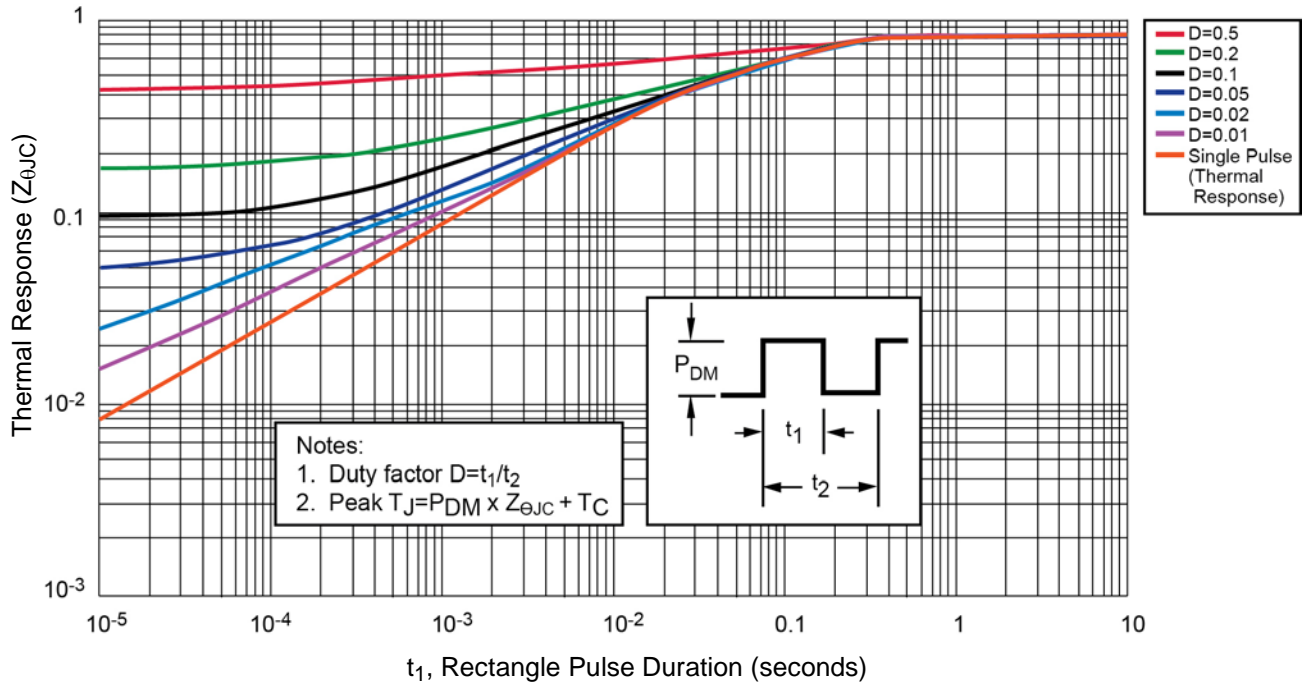
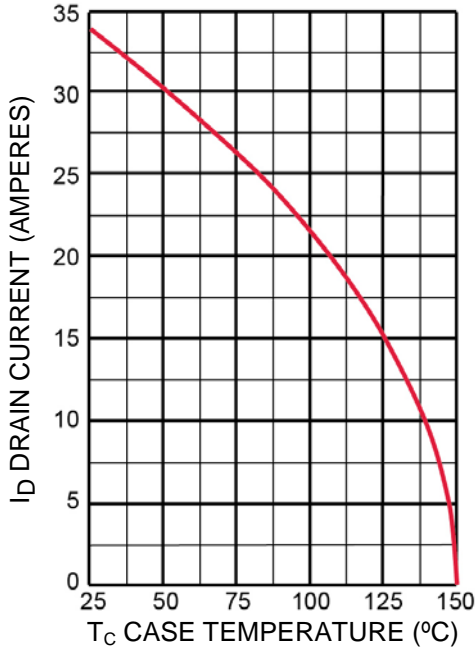
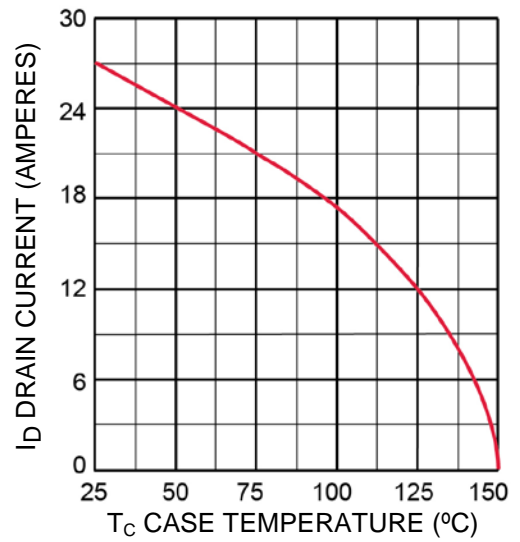
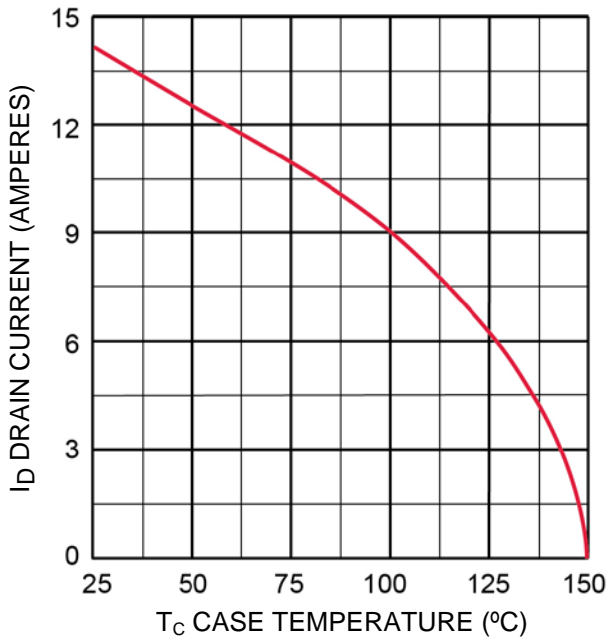
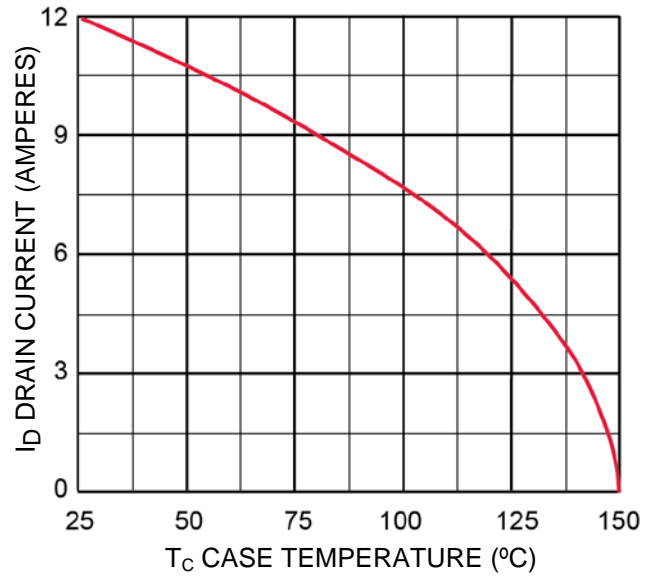
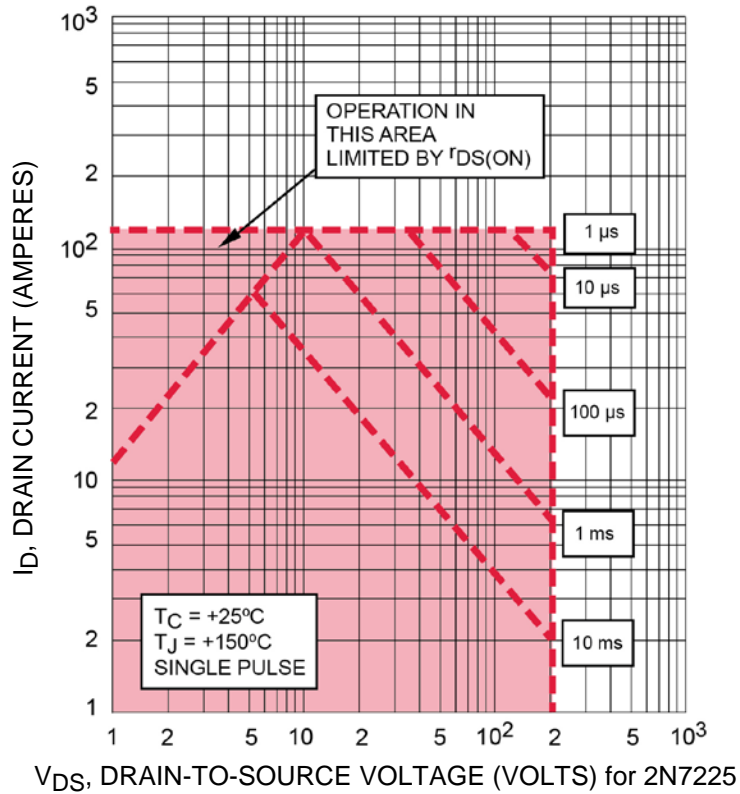
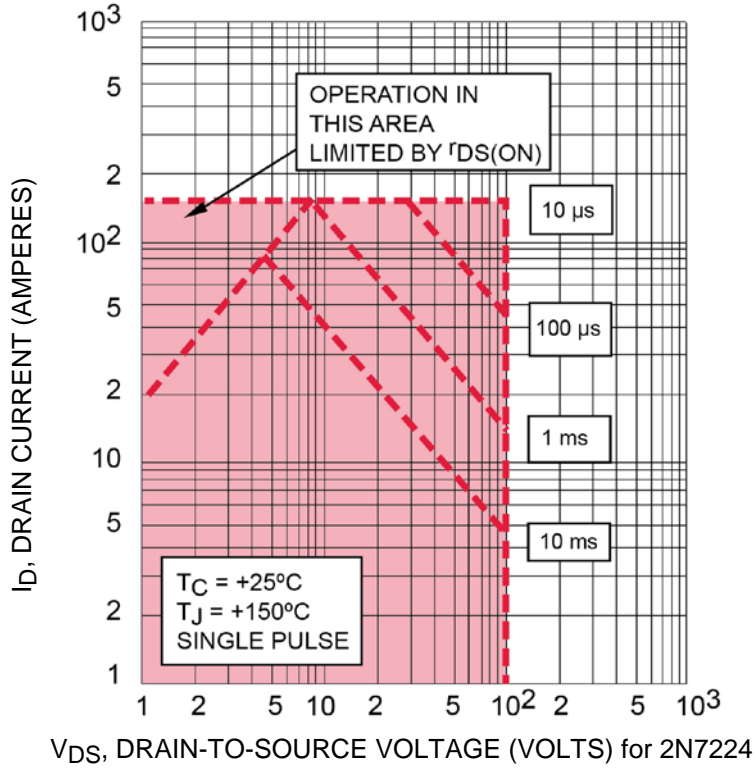


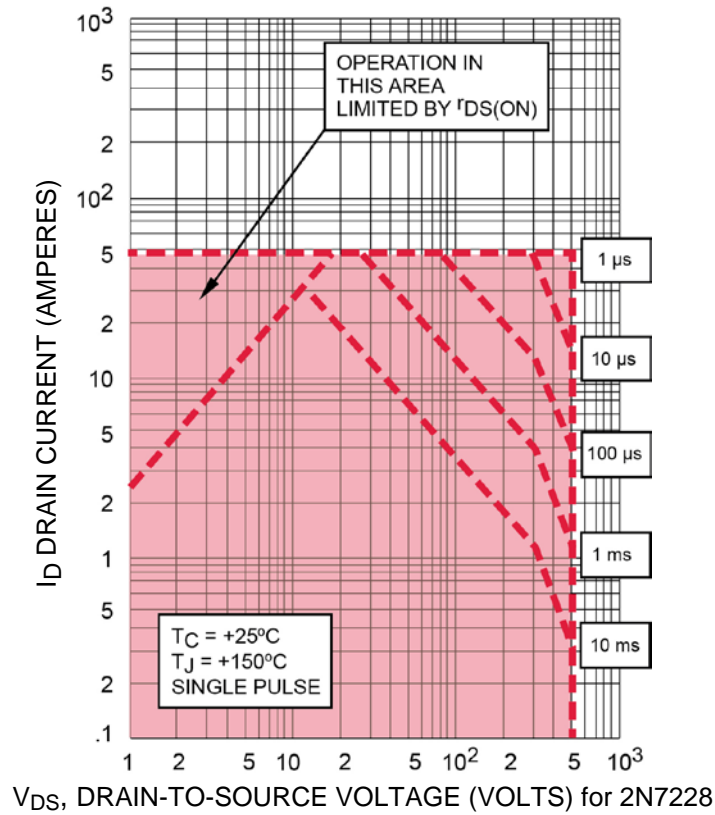
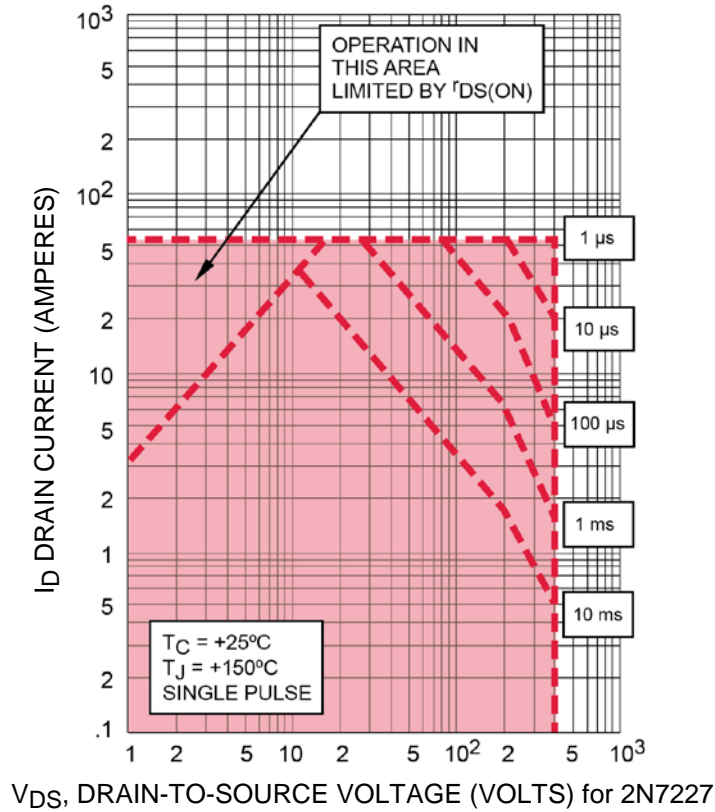
FIGURE 1
Thermal Impedance Curves

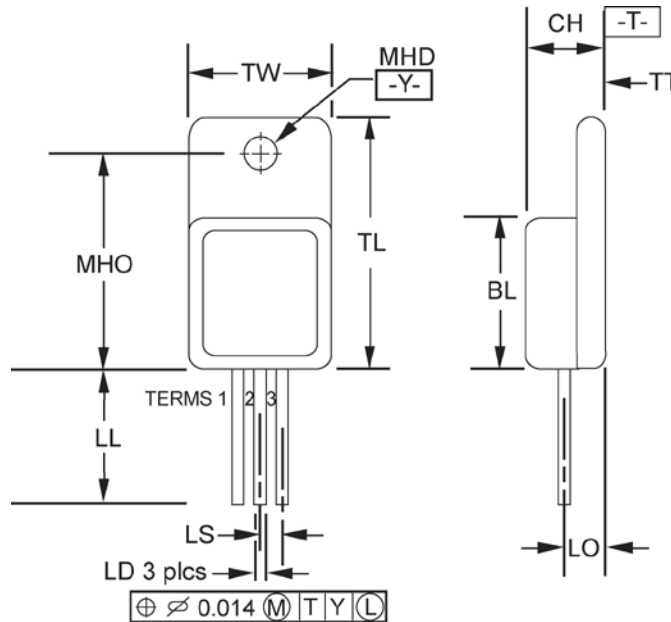
GRAPHS (continued)
FIGURE 2 – Maximum Drain Current vs Case Temperature Graphs

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 Φ x symbology.

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