RoHS Compliant

N-CHANNEL MOSFET

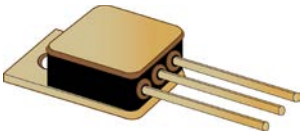
Qualified per MIL-PRF-19500/592

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.



TO-254AA Package

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.

Also available in:

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

MAXIMUM RATINGS @ T_A = +25ºC 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		$R_{\Theta JC}$	0.83	°C/W
Total Power Dissipation	@ T_A = +25 °C @ T_C = +25 °C (1)	P_T	4 150	W
Gate-Source Voltage, dc		V_{GS}	± 20	V
Drain Current, dc @ T_C = +25 ºC (2)	2N7224 2N7225 2N7227 2N7228	I_{D1}	34.0 27.4 14.0 12.0	A
Drain Current, dc @ T_C = +100 ºC (2)	2N7224 2N7225 2N7227 2N7228	I_{D2}	21 17 9 8	A
Off-State Current (Peak Total Value) (3)	2N7224 2N7225 2N7227 2N7228	I_{DM}	136 110 56 48	A (pk)
Source Current	2N7224 2N7225 2N7227 2N7228	I_S	34.0 27.4 14.0 12.0	A

NOTES:
1. Derated linearly by 1.2 W/ºC for T_C > +25 ºC.
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:

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

3. I_{DM} = 4 x I_{D1} as calculated in note 2.

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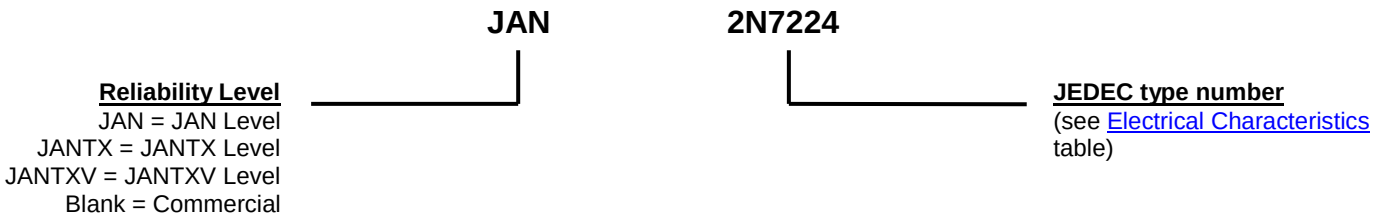
MECHANICAL and PACKAGING

- 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 °C, unless otherwise noted

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

ELECTRICAL CHARACTERISTICS @ T_A = +25 °C, unless otherwise noted (continued)

DYNAMIC CHARACTERISTICS

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

SWITCHING CHARACTERISTICS

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

GRAPHS

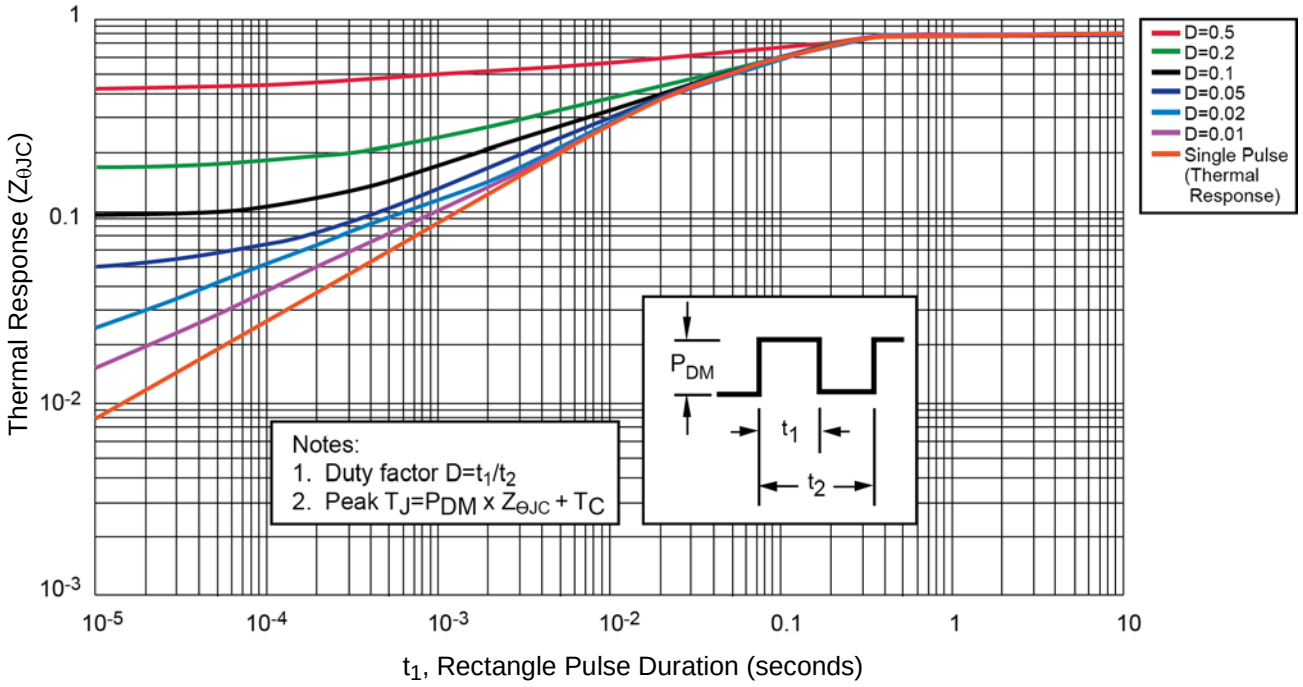
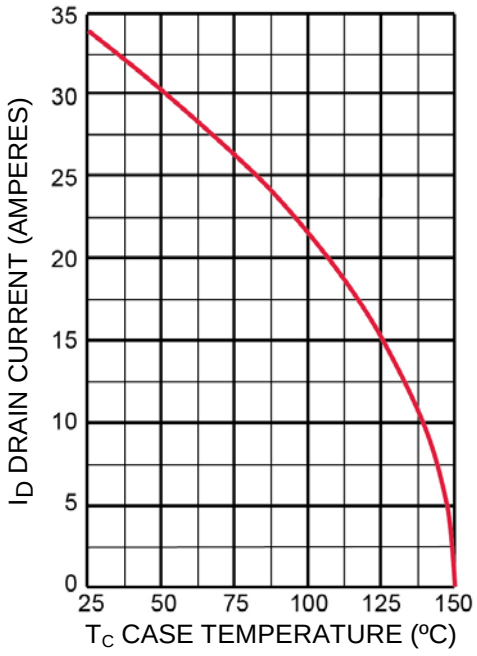


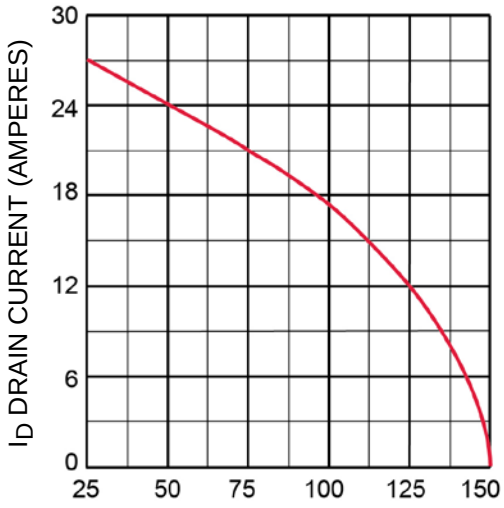
FIGURE 1
Thermal Impedance Curves

GRAPHS (continued)

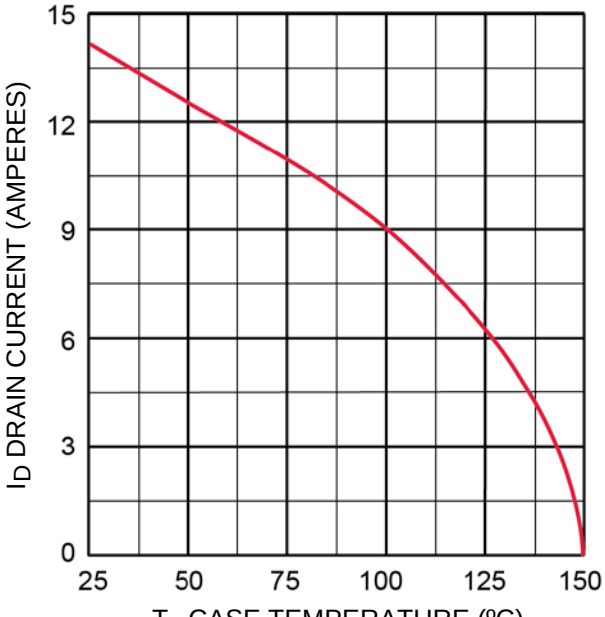
FIGURE 2 – Maximum Drain Current vs Case Temperature Graphs



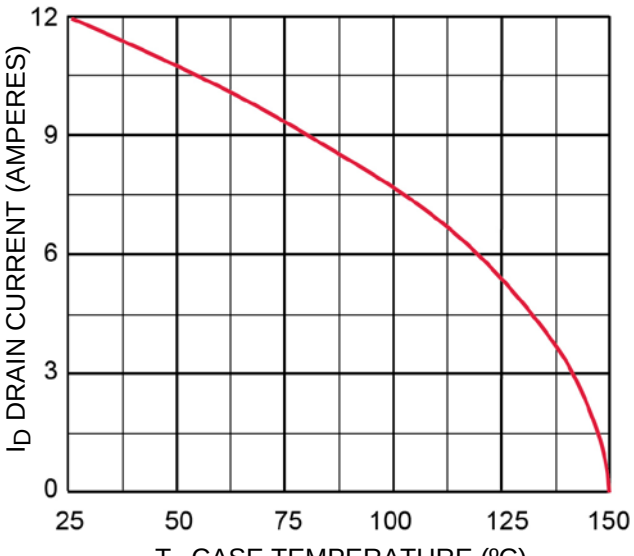
For 2N7224



For 2N7225



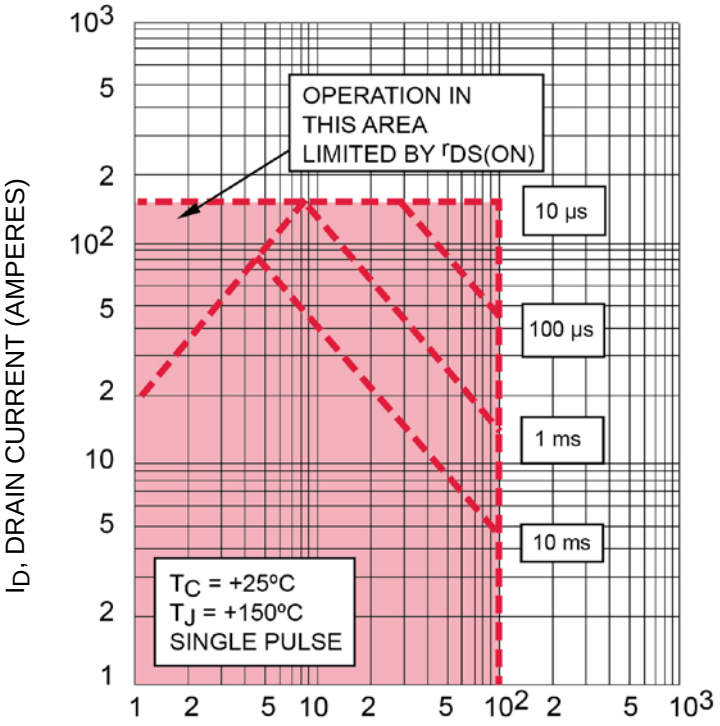
For 2N7227

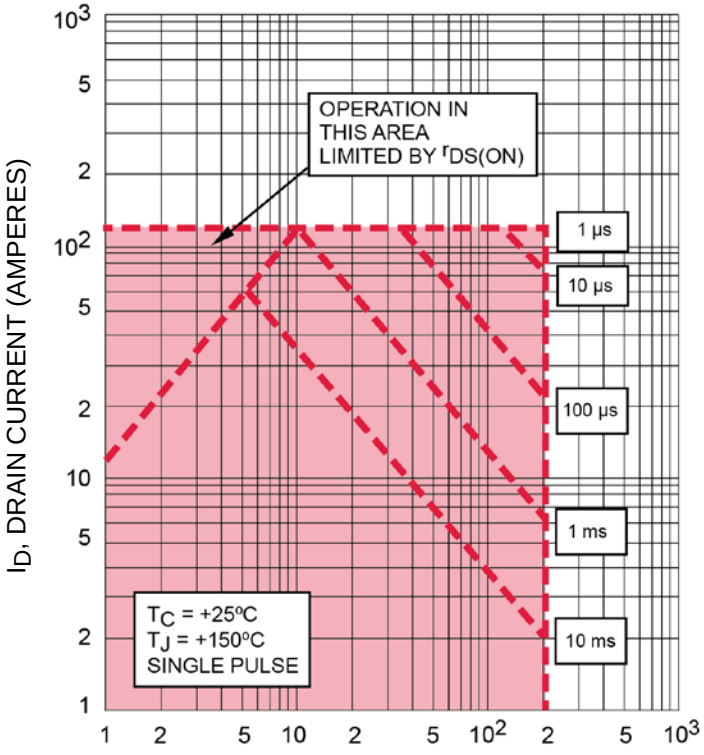


For 2N7228

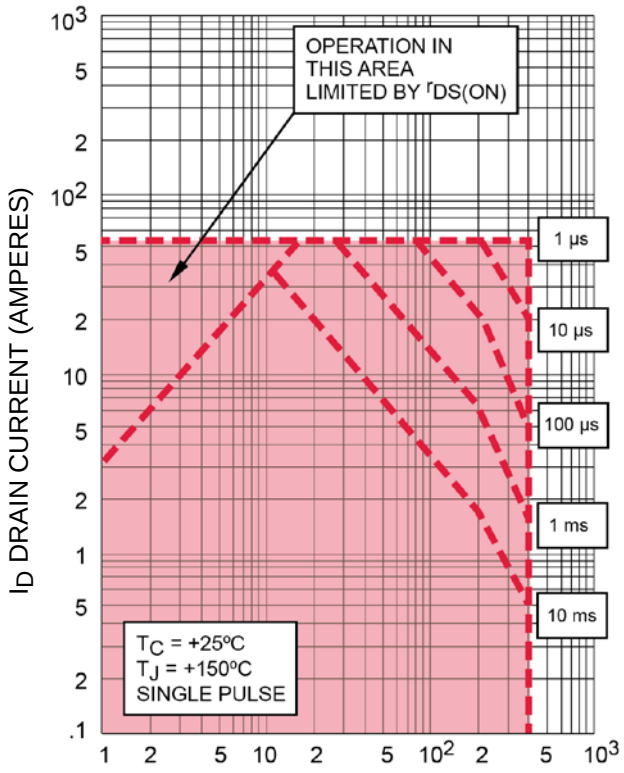
GRAPHS (continued)

FIGURE 3 – Maximum Safe Operating Area

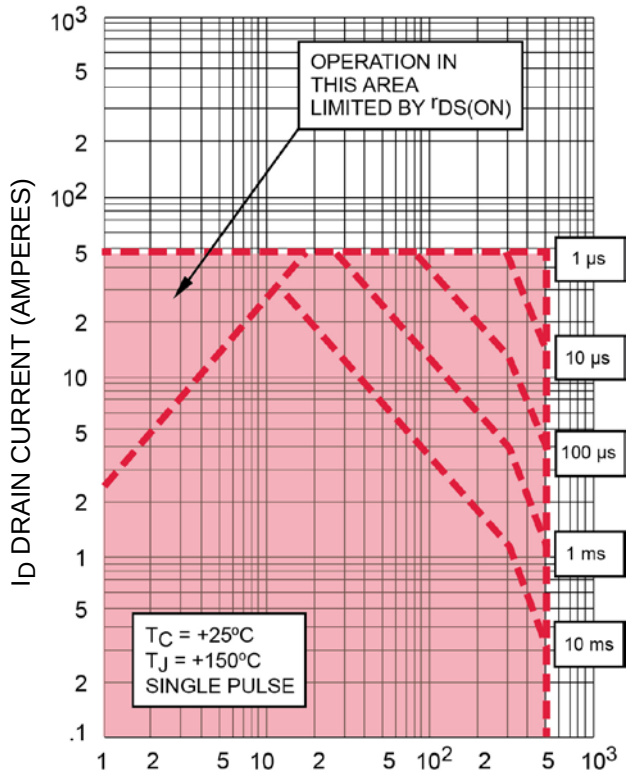




GRAPHS (continued)

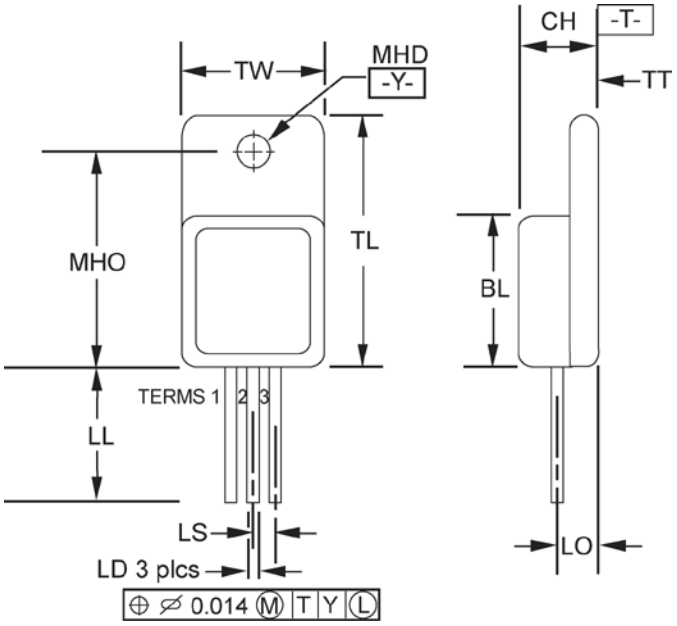


V_{DS}, DRAIN-TO-SOURCE VOLTAGE (VOLTS) for 2N7227



V_{DS}, DRAIN-TO-SOURCE VOLTAGE (VOLTS) for 2N7228

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 Φx 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				