

Power MOSFET



N-Channel MOSFET

FEATURES

- For automatic insertion
- Compact, end stackable
- Fast switching
- Ease of paralleling
- Excellent temperature stability
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

DESCRIPTION

The HVMDIP technology is the key to Vishay's advanced line of power MOSFET transistors. The efficient geometry and unique processing of the HVMDIP design achieves very low on-state resistance combined with high transconductance and extreme device ruggedness. HVMDIPs feature all of the established advantages of MOSFETs such as voltage control, very fast switching, ease of paralleling, and temperature stability of the electrical parameters.

The HVMDIP 4 pin, dual-in-line package brings the advantages of HVMDIPs to high volume applications where automatic PC board insertion is desirable, such as circuit boards for computers, printers, telecommunications equipment, and consumer products. Their compatibility with automatic insertion equipment, low-profile and end stackable features represent the state-of-the-art in power device packaging.

PRODUCT SUMMARY	
V_{DS} (V)	50
$R_{DS(on)}$ (Ω)	$V_{GS} = 10\text{ V}$ 0.10
Q_g (Max.) (nC)	24
Q_{gs} (nC)	7.1
Q_{gd} (nC)	7.1
Configuration	Single

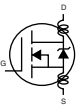

ORDERING INFORMATION	
Package	HVMDIP
Lead (Pb)-free	IRFD020PbF

ABSOLUTE MAXIMUM RATINGS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)				
PARAMETER		SYMBOL	LIMIT	UNIT
Drain-source voltage ^a		V_{DS}	50	V
Gate-source voltage		V_{GS}	± 20	
Continuous drain current	V_{GS} at 10 V	I_D	$T_C = 25\text{ }^\circ\text{C}$	2.4
			$T_C = 100\text{ }^\circ\text{C}$	1.5
Pulsed drain current ^a		I_{DM}	19	A
Linear derating factor			0.0080	$\text{W}/^\circ\text{C}$
Inductive current, clamped	$L = 100\text{ }\mu\text{H}$	I_{LM}	19	A
Unclamped inductive current (avalanche current) ^c		I_L	2.2	
Maximum power dissipation	$T_C = 25\text{ }^\circ\text{C}$	P_D	1.0	W
Operating junction and storage temperature range		T_J, T_{stg}	- 55 to + 150	$^\circ\text{C}$
Soldering recommendations (peak temperature)	For 10 s		300 ^d	

Notes

- $T_J = 25\text{ }^\circ\text{C}$ to $150\text{ }^\circ\text{C}$
- Repetitive rating; pulse width limited by maximum junction temperature
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 100\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$
- 1.6 mm from case

THERMAL RESISTANCE RATINGS				
PARAMETER	SYMBOL	TYP.	MAX.	UNIT
Maximum Junction-to-Ambient	R_{thJA}	-	120	°C/W

SPECIFICATIONS ($T_C = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$		50	-	-	V
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$		2.0	-	4.0	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 500	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = \text{max. rating}, V_{GS} = 0\text{ V}$		-	-	250	μA
		$V_{DS} = \text{max. rating} \times 0.8, V_{GS} = 0\text{ V}, T_C = 125$		-	-	1000	
On-State Drain Current ^b	$I_{D(on)}$	$V_{GS} = 10\text{ V}$	$V_{DS} > I_{D(on)} \times R_{DS(on)} \text{ max.}$	2.4	-	-	A
Drain-Source On-State Resistance ^b	$R_{DS(on)}$	$V_{GS} = 10\text{ V}$	$I_D = 1.4\text{ A}$	-	0.080	0.10	Ω
Forward Transconductance ^b	g_{fs}	$V_{DS} = 20\text{ V}, I_D = 7.5\text{ A}$		4.9	7.3	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V}, V_{DS} = 25\text{ V}, f = 1.0\text{ MHz}$		-	400	-	μF
Output Capacitance	C_{oss}			-	260	-	
Reverse Transfer Capacitance	C_{rss}			-	44	-	
Total Gate Charge	Q_g	$V_{GS} = 10\text{ V}$	$I_D = 15\text{ A}, V_{DS} = \text{max. rating} \times 0.8$	-	16	24	nC
Gate-Source Charge	Q_{gs}			-	4.7	7.1	
Gate-Drain Charge	Q_{gd}			-	4.7	7.1	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = 25\text{ V}, I_D = 15\text{ A}, R_g = 18\text{ }\Omega, R_D = 1.7\text{ }\Omega$		-	8.7	13	ns
Rise Time	t_r			-	55	83	
Turn-Off Delay Time	$t_{d(off)}$			-	16	24	
Fall Time	t_f			-	26	39	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact 		-	4.0	-	nH
Internal Source Inductance	L_S			-	6.0	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode 		-	-	2.4	A
Pulsed Diode Forward Current ^c	I_{SM}			-	-	19	
Body Diode Voltage ^a	V_{SD}	$T_C = 25\text{ }^\circ\text{C}, I_S = 2.4\text{ A}, V_{GS} = 0\text{ V}$		-	-	1.4	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = 15\text{ A}, di/dt = 100\text{ A}/\mu\text{s}$		57	130	310	ns
Body Diode Reverse Recovery Charge	Q_{rr}			0.17	0.34	0.85	μC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S and L_D)					

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$
- $V_{DD} = 25\text{ V}$, starting $T_J = 25\text{ }^\circ\text{C}$, $L = 100\text{ }\mu\text{H}$, $R_g = 25\text{ }\Omega$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

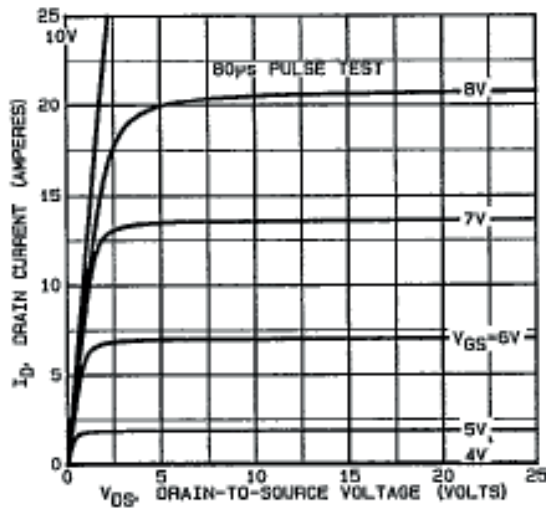


Fig. 1 - Typical Output Characteristics

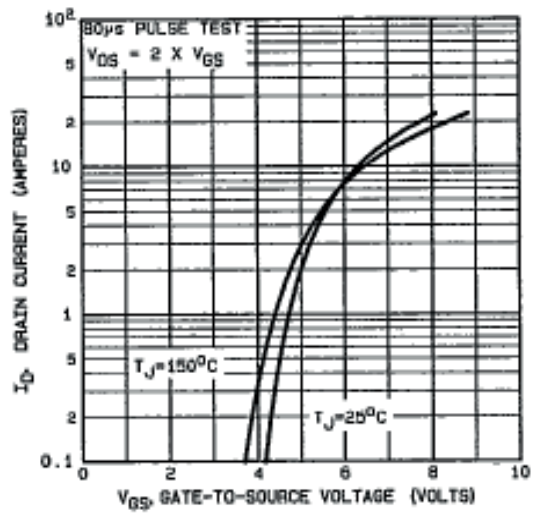


Fig. 3 - Typical Transfer Characteristics

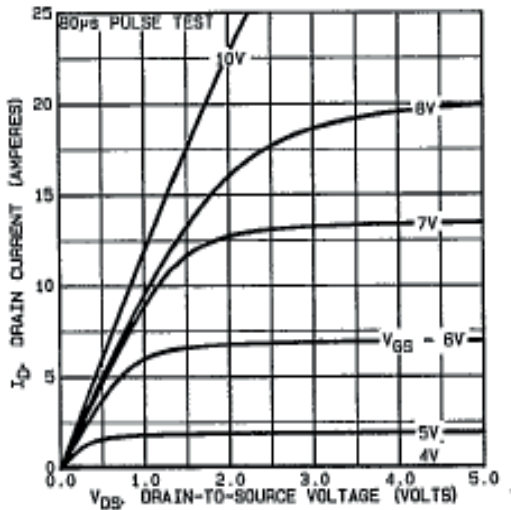


Fig. 2 - Typical Output Characteristics

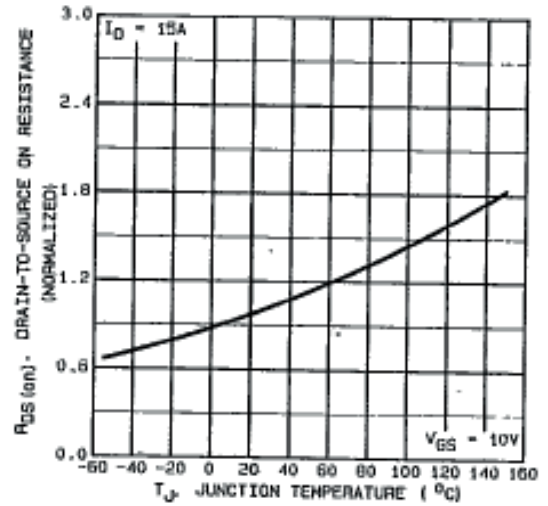


Fig. 4 - Normalized On-Resistance vs. Temperature

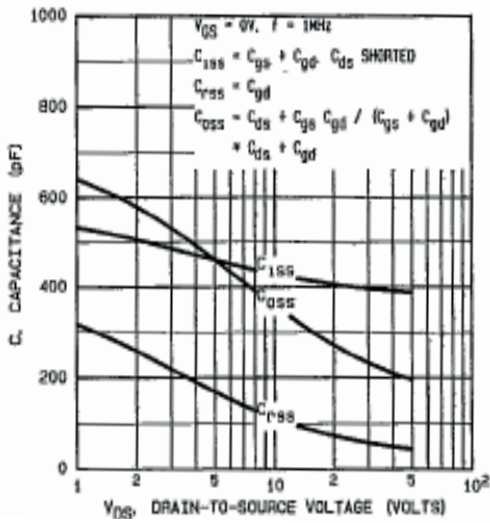


Fig. 5 - Typical Capacitance vs. Drain-to-Source Voltage

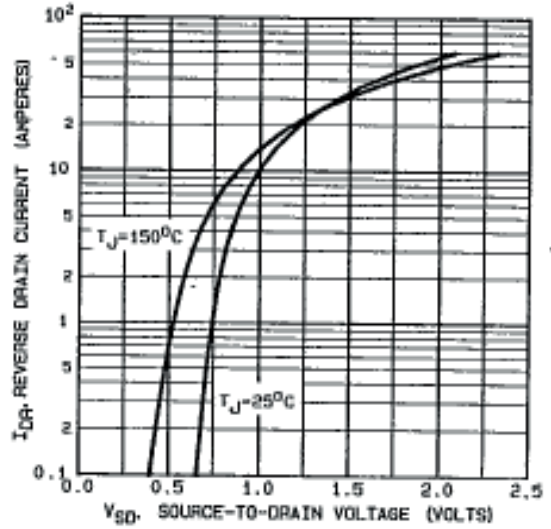


Fig. 7 - Typical Source-Drain Diode Forward Voltage

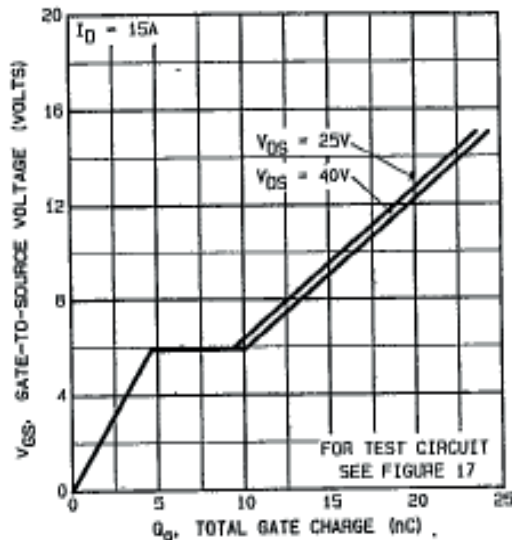


Fig. 6 - Typical Gate Charge vs. Gate-to-Source Voltage

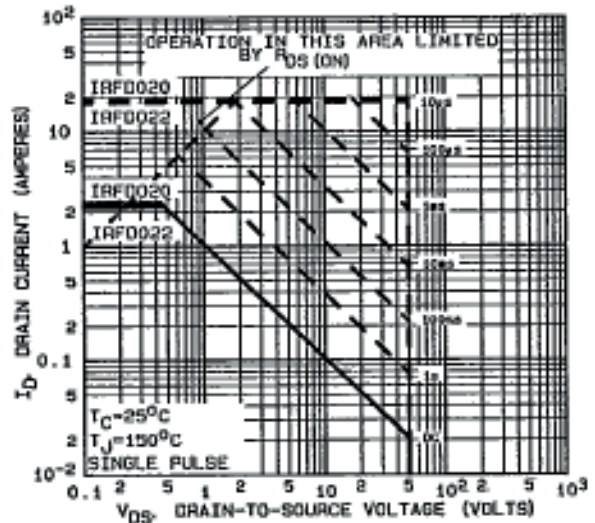


Fig. 8 - Maximum Safe Operating Area

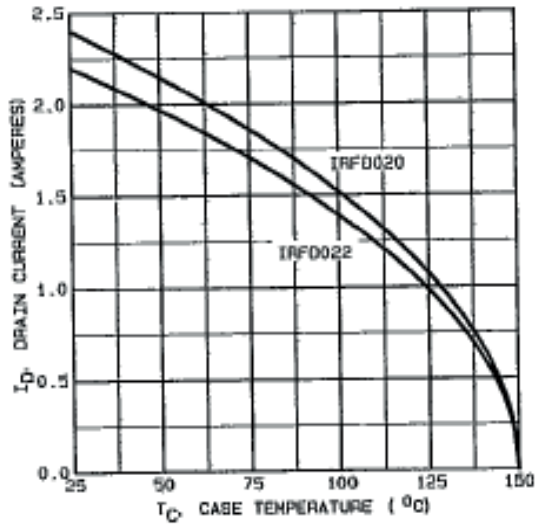


Fig. 9 - Maximum Drain Current vs. Ambient Temperature

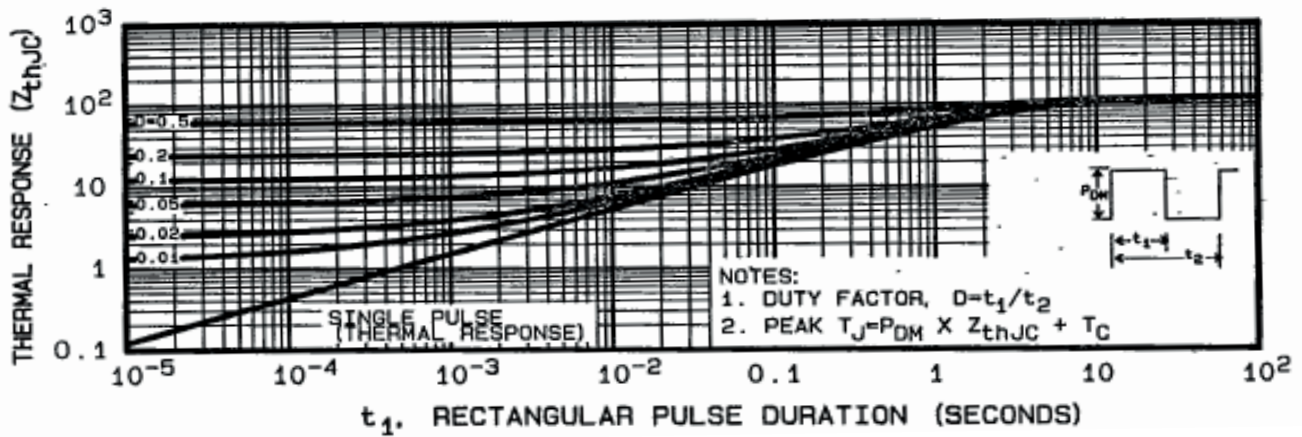


Fig. 10 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

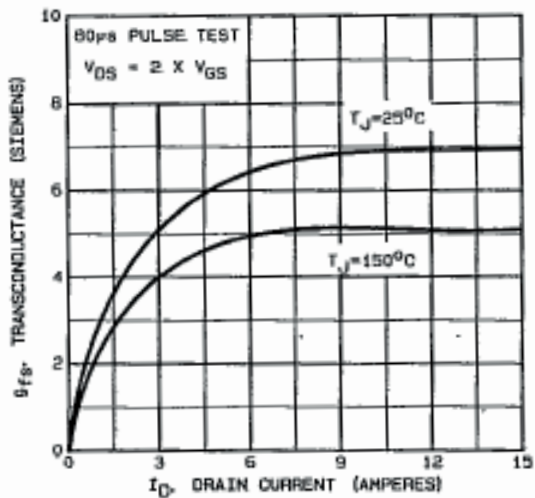


Fig. 11 - Typical Transconductance vs. Drain Current

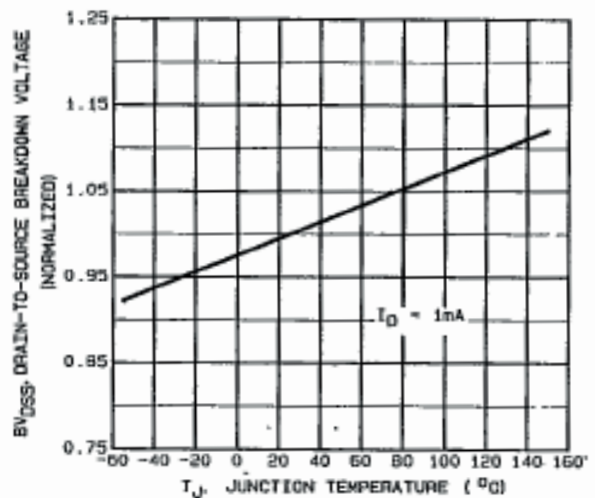


Fig. 12 - Breakdown Voltage vs. Temperature

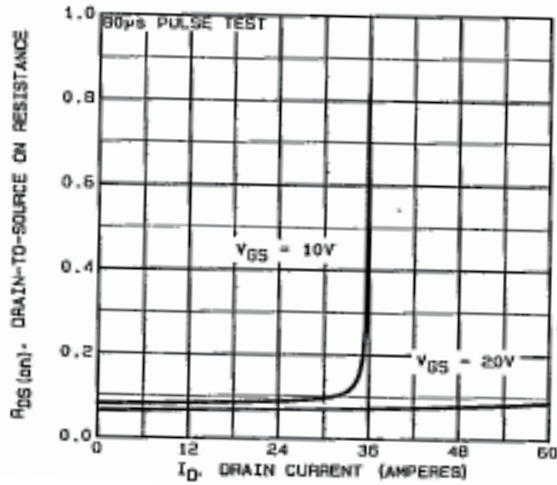


Fig. 13 - Typical on-Resistance vs. Drain Current

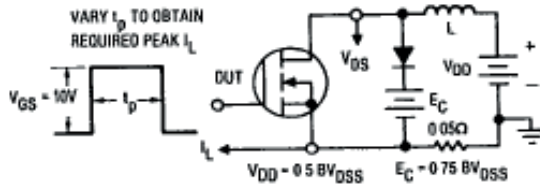


Fig. 14a - Clamped Inductive Test Circuit

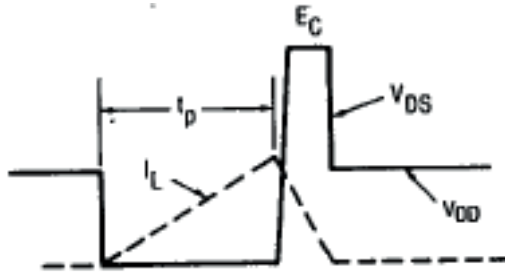


Fig. 14b - Clamped Inductive Waveforms

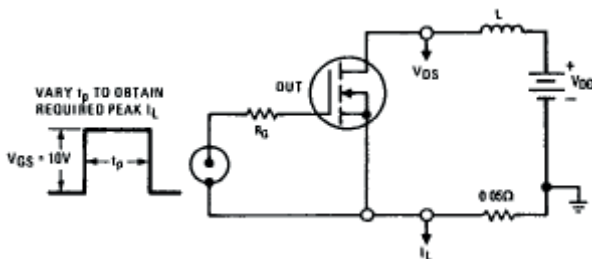


Fig. 15a - Unclamped Inductive Test Circuit

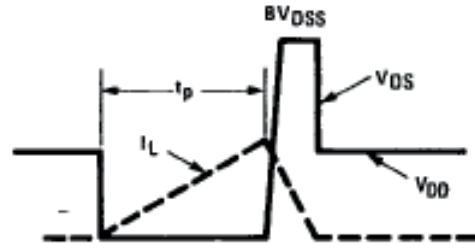


Fig. 15a - Unclamped Inductive Load Test Waveforms

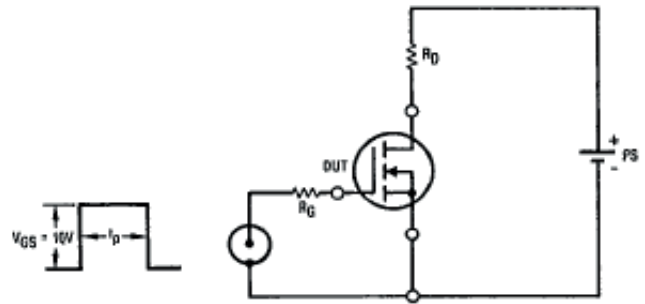


Fig. 16 - Switching Time Test Circuit

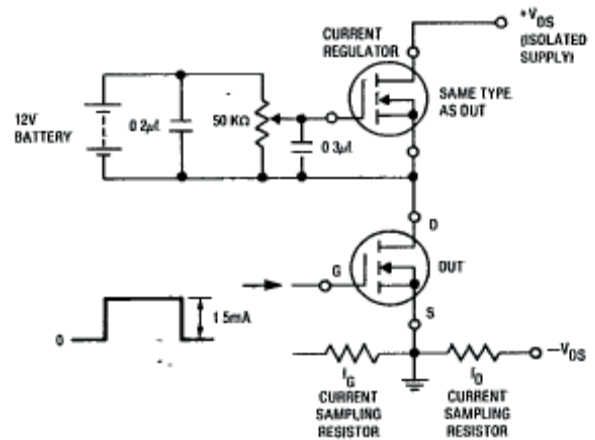


Fig. 17 - Gate Charge Test Circuit

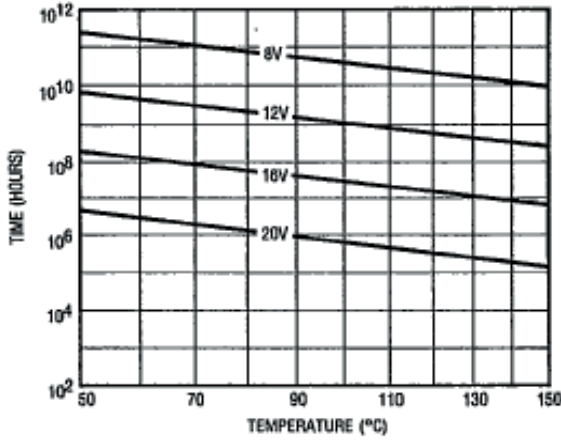


Fig. 18 - Typical Time to Accumulated 1 % Gate Failure

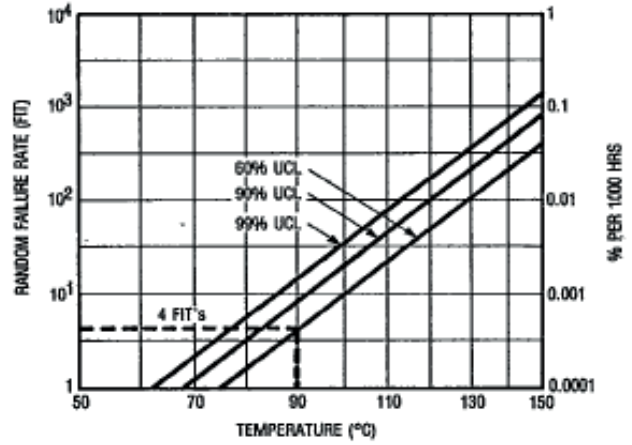


Fig. 19 - Typical High Temperature Reverse Bias (HTRB) Failure Rate

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HVM DIP (High voltage)



DIM.	INCHES		MILLIMETERS	
	MIN.	MAX.	MIN.	MAX.
A	0.310	0.330	7.87	8.38
E	0.300	0.425	7.62	10.79
L	0.270	0.290	6.86	7.36

ECN: X10-0386-Rev. B, 06-Sep-10
DWG: 5974

Note

- Package length does not include mold flash, protrusions or gate burrs. Package width does not include interlead flash or protrusions.



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