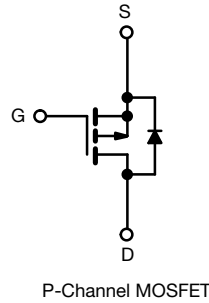


Power MOSFET



P-Channel MOSFET

FEATURES

- Dynamic dV/dt rating
- Repetitive avalanche rated
- For automatic insertion
- End stackable
- P-channel
- Fast switching
- Ease of paralleling
- Material categorization: for definitions of compliance please see www.vishay.com/doc?99912


RoHS
COMPLIANT

PRODUCT SUMMARY

V_{DS} (V)	-200	
$R_{DS(on)}$ (Ω)	$V_{GS} = -10$ V	1.5
Q_g (Max.) (nC)	15	
Q_{gs} (nC)	3.2	
Q_{gd} (nC)	8.4	
Configuration	Single	

DESCRIPTION

Third generation power MOSFETs from Vishay provide the designer with the best combination of fast switching, ruggedized device design, low on-resistance and cost-effectiveness.

The 4 pin DIP package is a low cost machine-insertable case style which can be stacked in multiple combinations on standard 0.1" pin centers. The dual drain serves as a thermal link to the mounting surface for power dissipation levels up to 1 W.

ORDERING INFORMATION

Package	HVMDIP
Lead (Pb)-free	IRFD9220PbF

ABSOLUTE MAXIMUM RATINGS ($T_A = 25$ °C, unless otherwise noted)

PARAMETER	SYMBOL	LIMIT	UNIT	
Drain-source voltage	V_{DS}	-200	V	
Gate-source voltage	V_{GS}	± 20		
Continuous drain current	V_{GS} at -10 V	$T_A = 25$ °C	-0.56	A
		$T_A = 100$ °C	-0.36	
Pulsed drain current ^a	I_{DM}	-4.5		
Linear derating factor		0.0083	W/°C	
Single pulse avalanche energy ^b	E_{AS}	80	mJ	
Repetitive avalanche current ^a	I_{AR}	-0.56	A	
Repetitive avalanche energy ^a	E_{AR}	0.10	mJ	
Maximum power dissipation	$T_A = 25$ °C	P_D	1	W
Peak diode recovery dv/dt ^c		dV/dt	-5	V/ns
Operating junction and storage temperature range	T_J, T_{stg}		-55 to +150	°C
Soldering rRecommendations (peak temperature) ^d	For 10 s		300 ^d	

Notes

- Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
- $V_{DD} = -50$ V, starting $T_J = 25$ °C, $L = 17.8$ mH, $R_g = 25$ Ω , $I_{AS} = -3$ A (see fig. 12)
- $I_{SD} \leq -3.9$ A, $dI/dt \leq 95$ A/ μ s, $V_{DD} \leq V_{DS}$, $T_J \leq 150$ °C
- 1.6 mm from case

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

SPECIFICATIONS ($T_J = 25\text{ }^\circ\text{C}$, unless otherwise noted)							
PARAMETER	SYMBOL	TEST CONDITIONS		MIN.	TYP.	MAX.	UNIT
Static							
Drain-Source Breakdown Voltage	V_{DS}	$V_{GS} = 0\text{ V}, I_D = -250\text{ }\mu\text{A}$		-200	-	-	V
V_{DS} Temperature Coefficient	$\Delta V_{DS}/T_J$	Reference to $25\text{ }^\circ\text{C}$, $I_D = -1\text{ mA}$		-	-0.22	-	V/°C
Gate-Source Threshold Voltage	$V_{GS(th)}$	$V_{DS} = V_{GS}, I_D = -250\text{ }\mu\text{A}$		-2	-	-4	V
Gate-Source Leakage	I_{GSS}	$V_{GS} = \pm 20\text{ V}$		-	-	± 100	nA
Zero Gate Voltage Drain Current	I_{DSS}	$V_{DS} = -200\text{ V}, V_{GS} = 0\text{ V}$		-	-	-100	μA
		$V_{DS} = -160\text{ V}, V_{GS} = 0\text{ V}, T_J = 125\text{ }^\circ\text{C}$		-	-	-500	
Drain-Source On-State Resistance	$R_{DS(on)}$	$V_{GS} = -10\text{ V}$	$I_D = -0.34\text{ A}^b$	-	-	1.5	Ω
Forward Transconductance	g_{fs}	$V_{DS} = -50\text{ V}, I_D = -0.35\text{ A}^b$		0.55	-	-	S
Dynamic							
Input Capacitance	C_{iss}	$V_{GS} = 0\text{ V},$ $V_{DS} = -25\text{ V},$ $f = 1\text{ MHz}$, see fig. 5		-	340	-	μF
Output Capacitance	C_{oss}			-	110	-	
Reverse Transfer Capacitance	C_{rss}			-	33	-	
Total Gate Charge	Q_g	$V_{GS} = -10\text{ V}$	$I_D = -2.1\text{ A}, V_{DS} = -160\text{ V},$ see fig. 6 and 13 ^b	-	-	15	nC
Gate-Source Charge	Q_{gs}			-	-	3.2	
Gate-Drain Charge	Q_{gd}			-	-	8.4	
Turn-On Delay Time	$t_{d(on)}$	$V_{DD} = -100\text{ V}, I_D = -3.9\text{ A},$ $R_g = 18\text{ }\Omega, R_D = 24\text{ }\Omega$, see fig. 10 ^b		-	8.8	-	ns
Rise Time	t_r			-	27	-	
Turn-Off Delay Time	$t_{d(off)}$			-	7.3	-	
Fall Time	t_f			-	19	-	
Internal Drain Inductance	L_D	Between lead, 6 mm (0.25") from package and center of die contact		-	4	-	nH
Internal Source Inductance	L_S			-	6	-	
Drain-Source Body Diode Characteristics							
Continuous Source-Drain Diode Current	I_S	MOSFET symbol showing the integral reverse p - n junction diode		-	-	-0.56	A
Pulsed Diode Forward Current ^a	I_{SM}			-	-	-4.5	
Body Diode Voltage	V_{SD}	$T_J = 25\text{ }^\circ\text{C}, I_S = -0.56\text{ A}, V_{GS} = 0\text{ V}^b$		-	-	-6.3	V
Body Diode Reverse Recovery Time	t_{rr}	$T_J = 25\text{ }^\circ\text{C}, I_F = -3.9\text{ A}, dI/dt = 100\text{ A}/\mu\text{s}^b$		-	150	300	ns
Body Diode Reverse Recovery Charge	Q_{rr}			-	0.97	2	μC

Notes

- a. Repetitive rating; pulse width limited by maximum junction temperature (see fig. 11)
 b. Pulse width $\leq 300\text{ }\mu\text{s}$; duty cycle $\leq 2\%$

TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)

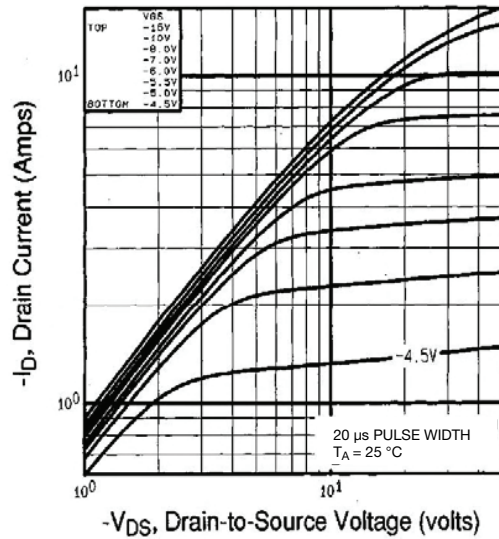


Fig. 1 - Typical Output Characteristics, $T_A = 25\text{ }^\circ\text{C}$

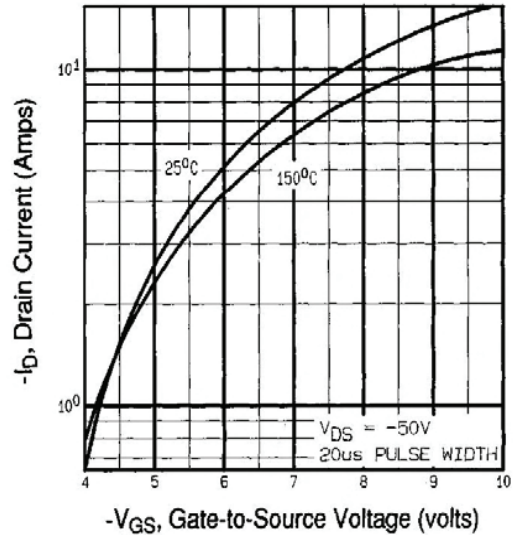


Fig. 2 - Typical Transfer Characteristics

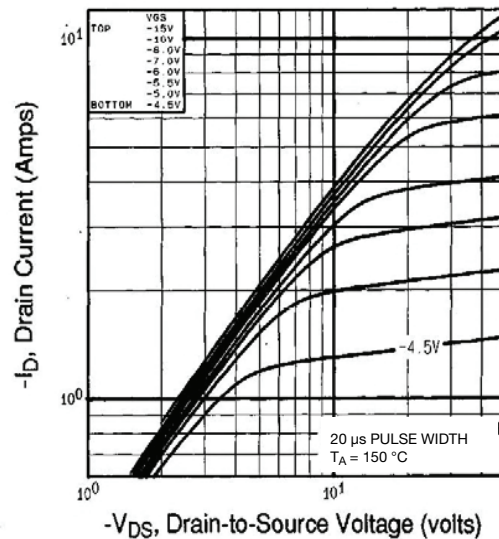


Fig. 1 - Typical Output Characteristics, $T_A = 150\text{ }^\circ\text{C}$

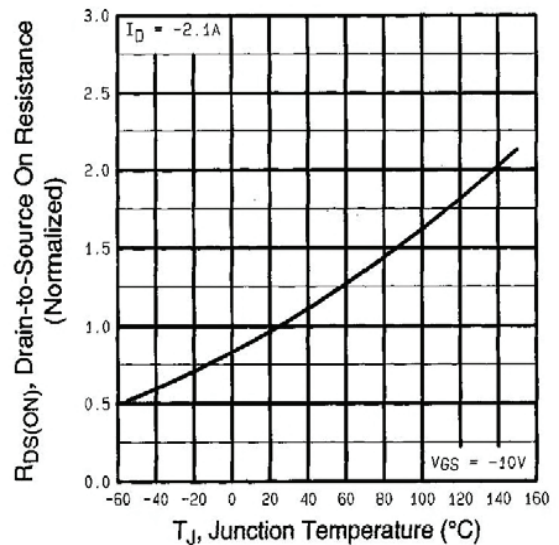


Fig. 3 - Normalized On-Resistance vs. Temperature

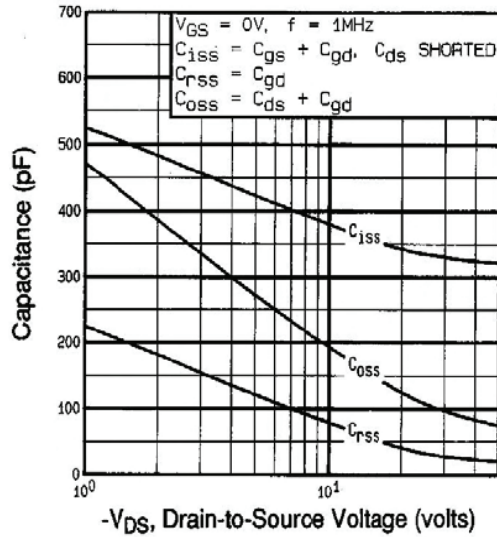


Fig. 4 - Typical Capacitance vs. Drain-to-Source Voltage

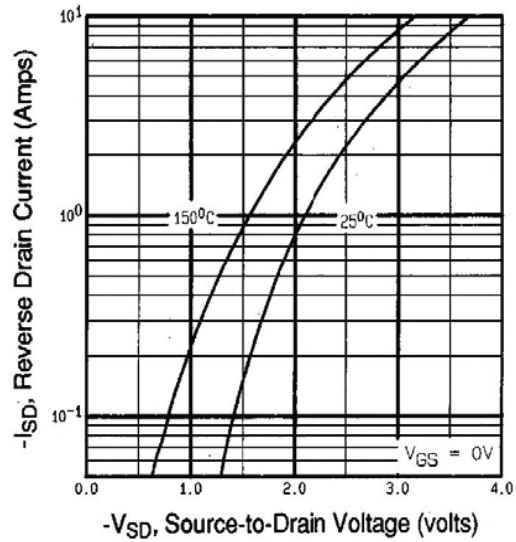


Fig. 6 - Typical Source-Drain Diode Forward Voltage

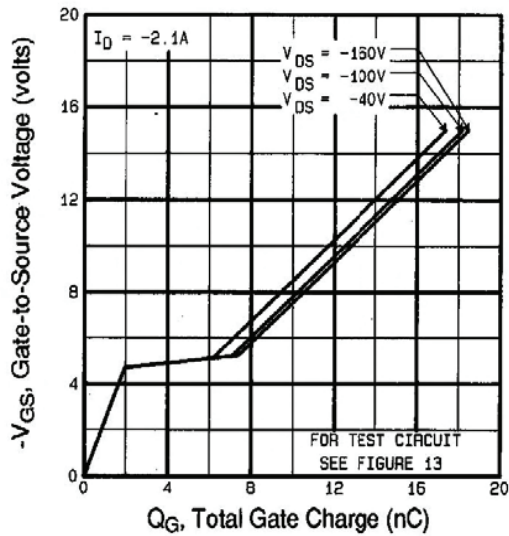


Fig. 5 - Typical Gate Charge vs. Gate-to-Source Voltage

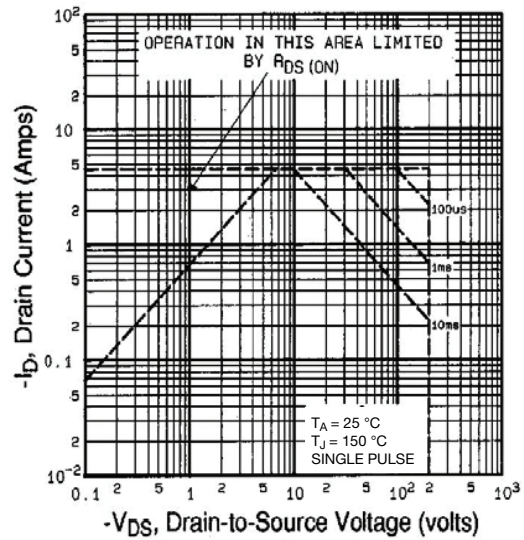


Fig. 7 - Maximum Safe Operating Area

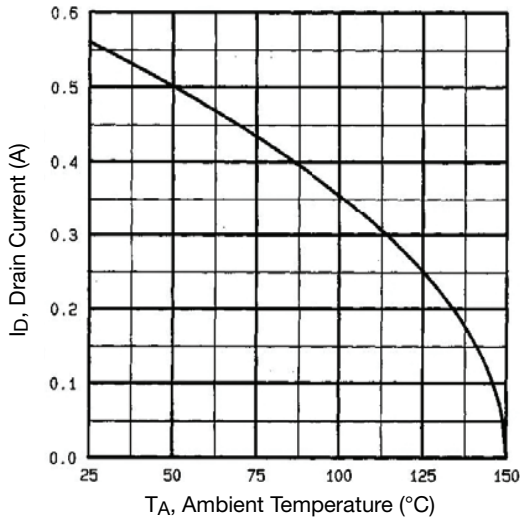


Fig. 8 - Maximum Drain Current vs. Ambient Temperature

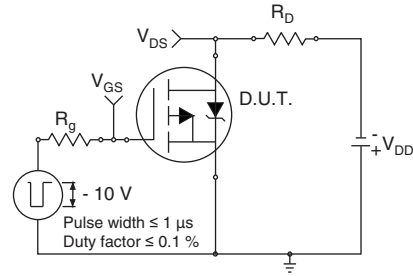


Fig. 9 - Switching Time Test Circuit

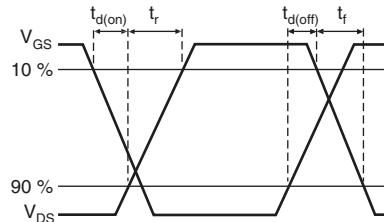


Fig. 10 - Switching Time Waveforms

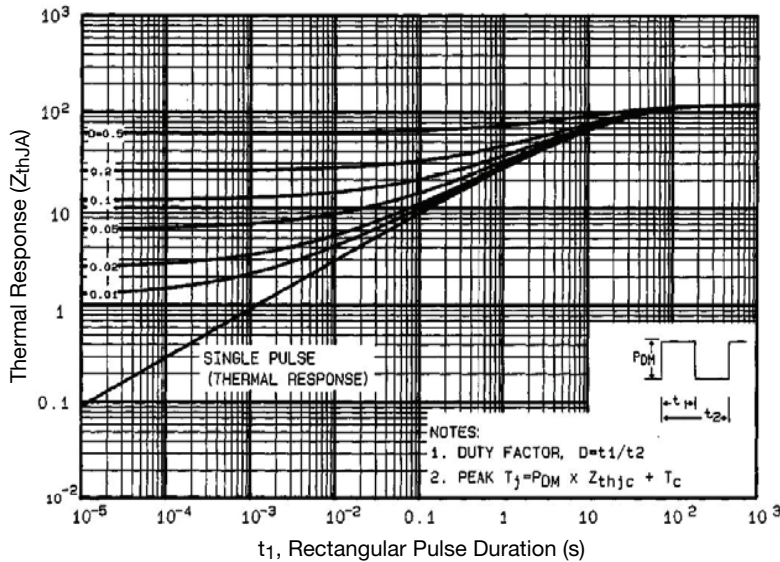


Fig. 11 - Maximum Effective Transient Thermal Impedance, Junction-to-Ambient

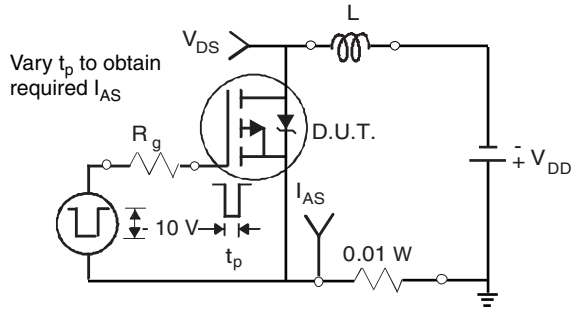


Fig. 12 - Unclamped Inductive Test Circuit

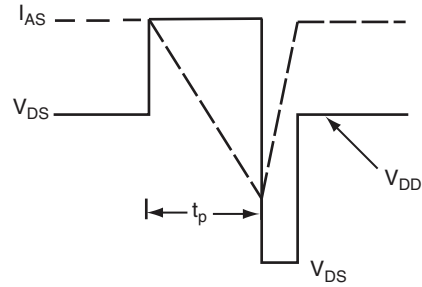


Fig. 13 - Unclamped Inductive Waveforms

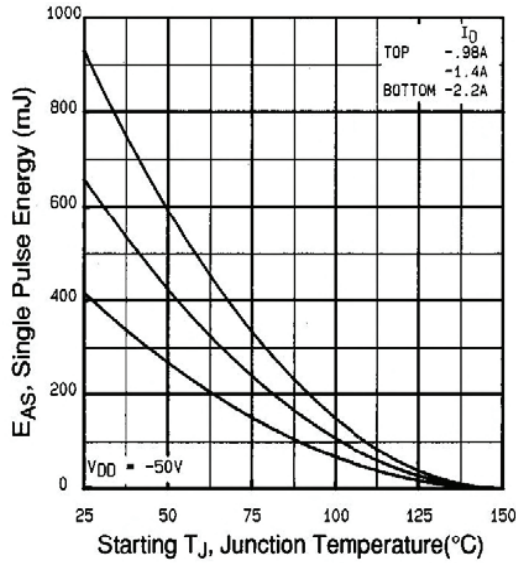


Fig. 14 - Maximum Avalanche Energy vs. Drain Current

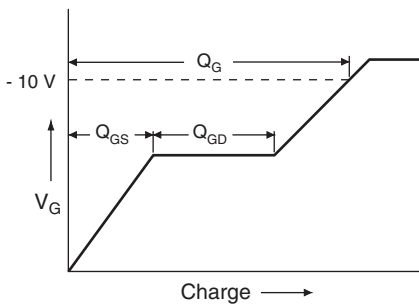


Fig. 15 - Basic Gate Charge Waveform

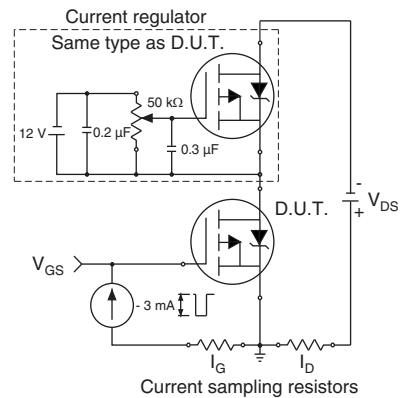
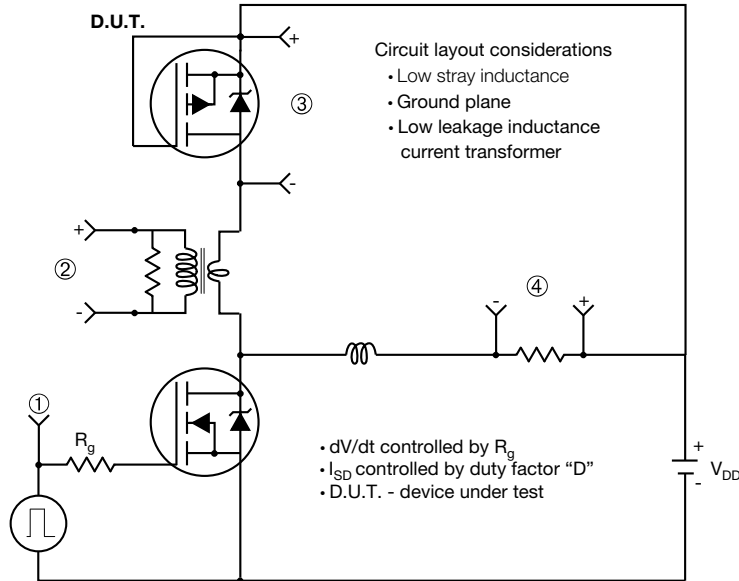
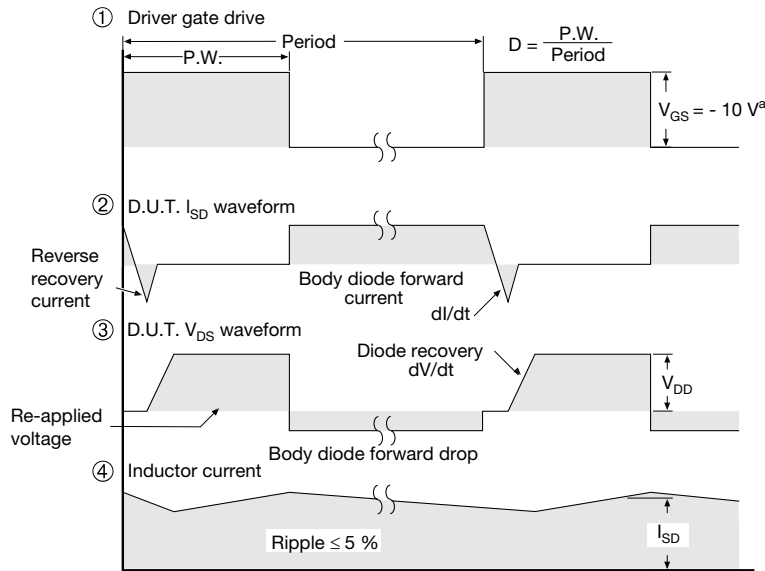


Fig. 16 - Gate Charge Test Circuit

Peak Diode Recovery dV/dt Test Circuit



Note
• Compliment N-Channel of D.U.T. for driver



Note
a. $V_{GS} = -5\text{ V}$ for logic level and -3 V drive devices

Fig. 17 - For P-Channel

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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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