ALPHA & OMEGA SEMICONDUCTOR, LTD.

June 2004

AOU402, AOU402L (Green Product)
N-Channel Enhancement Mode Field Effect Transistor

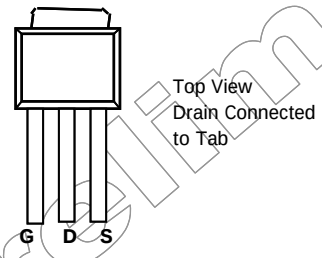
General Description

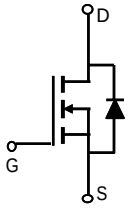
The AOU402 uses advanced trench technology and design to provide excellent $R_{DS(ON)}$ with low gate charge. This device is suitable for use in PWM, laod switching and general purpose applications. AOU402L(Green Product) is offered in a lead-free package.

Features

V_{DS} (V) = 60V
I_D = 12 A
$R_{DS(ON)}$ < 60 mΩ (V_{GS} = 10V)
$R_{DS(ON)}$ < 85 mΩ (V_{GS} = 4.5V)

TO-251





Absolute Maximum Ratings T_A=25°C unless otherwise noted

Parameter		Symbol	Maximum	Units
Drain-Source Voltage		V_{DS}	60	V
Gate-Source Voltage		V_{GS}	±20	V
Continuous Drain Current [G]	T_C=25°C	I_D	12	A
	T_C=100°C		12	
Pulsed Drain Current [C]		I_{DM}	30	
Avalanche Current [C]		I_{AR}	12	A
Repetitive avalanche energy L=0.1mH [C]		E_{AR}	23	mJ
Power Dissipation [B]	T_C=25°C	P_D	20	W
	T_C=100°C		10	
Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C

Thermal Characteristics

Parameter		Symbol	Typ	Max	Units
Maximum Junction-to-Ambient [A]	Steady-State	$R_{\theta JA}$	100	125	°C/W
Maximum Junction-to-Case [B]	Steady-State	$R_{\theta JC}$	4	7.5	°C/W

Electrical Characteristics (T_J=25°C unless otherwise noted)

Symbol	Parameter	Conditions	Min	Typ	Max	Units
STATIC PARAMETERS						
BV_{DSS}	Drain-Source Breakdown Voltage	I_D=10mA, V_{GS}=0V	60			V
I_{DSS}	Zero Gate Voltage Drain Current	V_{DS}=48V, V_{GS}=0V			1	µA
		T_J=55°C			5	
I_{GSS}	Gate-Body leakage current	V_{DS}=0V, V_{GS}=±20V			100	nA
$V_{GS(th)}$	Gate Threshold Voltage	V_{DS}=V_{GS}, I_D=250µA	1	2.4	3	V
$I_{D(ON)}$	On state drain current	V_{GS}=10V, V_{DS}=5V	30			A
$R_{DS(ON)}$	Static Drain-Source On-Resistance	V_{GS}=10V, I_D=12A		47	60	mΩ
		T_J=125°C		85		
		V_{GS}=4.5V, I_D=6A		67	85	mΩ
g_{FS}	Forward Transconductance	V_{DS}=5V, I_D=12A		14		S
V_{SD}	Diode Forward Voltage	I_S=1A, V_{GS}=0V		0.74	1	V
I_S	Maximum Body-Diode Continuous Current				12	A
DYNAMIC PARAMETERS						
C_{iss}	Input Capacitance	V_{GS}=0V, V_{DS}=30V, f=1MHz		385	540	pF
C_{oss}	Output Capacitance			55		pF
C_{rss}	Reverse Transfer Capacitance			20		pF
R_g	Gate resistance	V_{GS}=0V, V_{DS}=0V, f=1MHz		1.35	2	Ω
SWITCHING PARAMETERS						
Q_g(10V)	Total Gate Charge	V_{GS}=10V, V_{DS}=30V, I_D=12A		7.5	10	nC
Q_g(4.5V)	Total Gate Charge			3.8	5	nC
Q_{gs}	Gate Source Charge			1.2		nC
Q_{gd}	Gate Drain Charge			1.9		nC
$t_{D(on)}$	Turn-On DelayTime	V_{GS}=10V, V_{DS}=30V, R_L=2.5Ω, R_{GEN}=3Ω		4.2		ns
t_r	Turn-On Rise Time			3.4		ns
$t_{D(off)}$	Turn-Off DelayTime			16		ns
t_f	Turn-Off Fall Time			2		ns
t_{rr}	Body Diode Reverse Recovery Time	I_F=12A, dI/dt=100A/µs		27.6	35	ns
Q_{rr}	Body Diode Reverse Recovery Charge	I_F=12A, dI/dt=100A/µs		30		nC

A: The value of $R_{\theta JA}$ is measured with the device in a still air environment with T_A=25°C.

B. The power dissipation P_D is based on $T_{J(MAX)}$=175°C, using junction-to-case thermal resistance, and is more useful in setting the upper dissipation limit for cases where additional heatsinking is used.

C: Repetitive rating, pulse width limited by junction temperature $T_{J(MAX)}$=175°C.

D. The $R_{\theta JA}$ is the sum of the thermal impedence from junction to case $R_{\theta JC}$ and case to ambient.

E. The static characteristics in Figures 1 to 6 are obtained using <300 µs pulses, duty cycle 0.5% max.

F. These curves are based on the junction-to-case thermal impedence which is measured with the device mounted to a large heatsink, assuming a maximum junction temperature of $T_{J(MAX)}$=175°C.

G. The maximum current rating is limited by bond-wires.

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

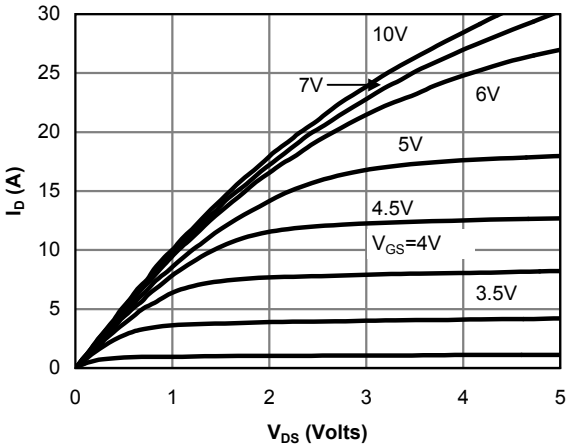


Fig 1: On-Region Characteristics

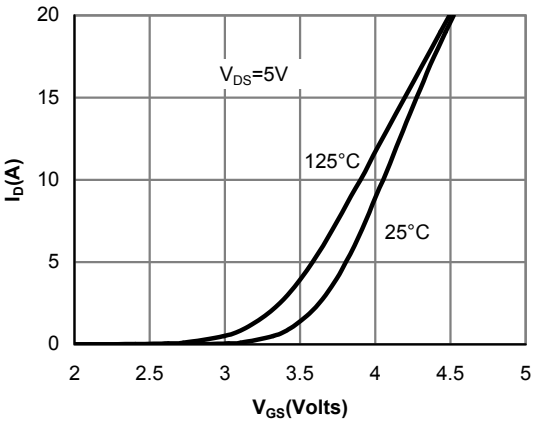


Figure 2: Transfer Characteristics

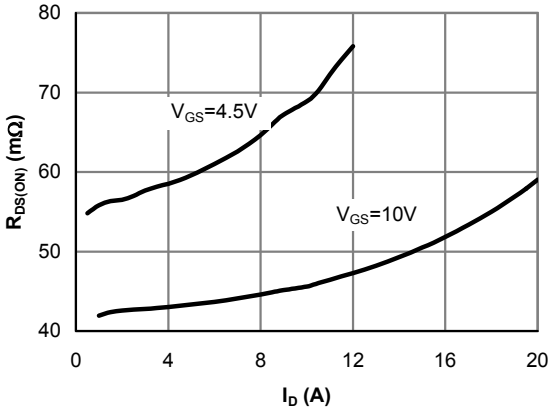


Figure 3: On-Resistance vs. Drain Current and Gate Voltage

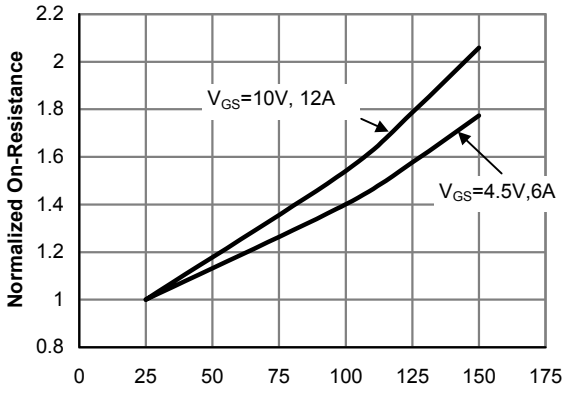


Figure 4: On-Resistance vs. Junction Temperature

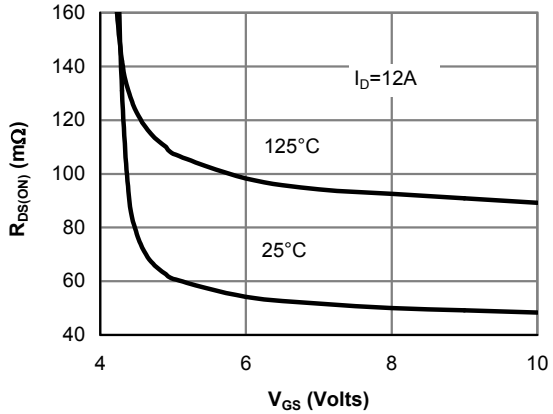


Figure 5: On-Resistance vs. Gate-Source Voltage

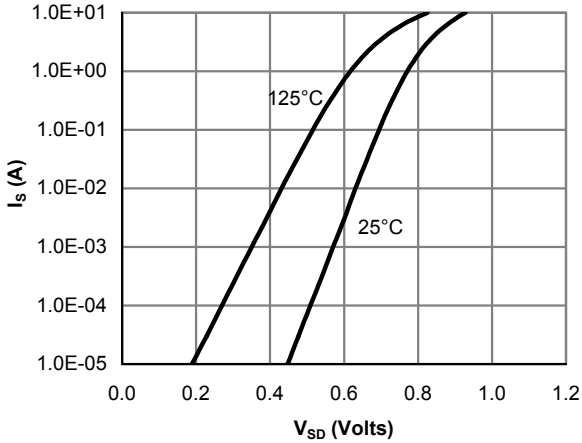


Figure 6: Body-Diode Characteristics

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

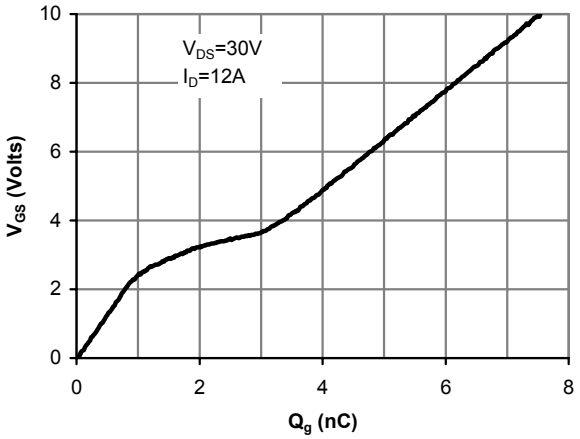


Figure 7: Gate-Charge Characteristics

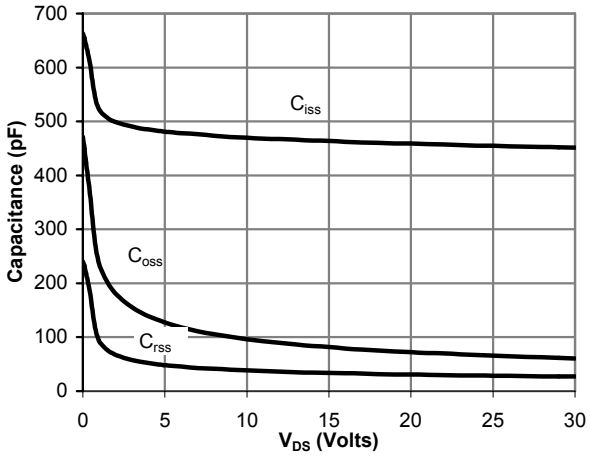


Figure 8: Capacitance Characteristics

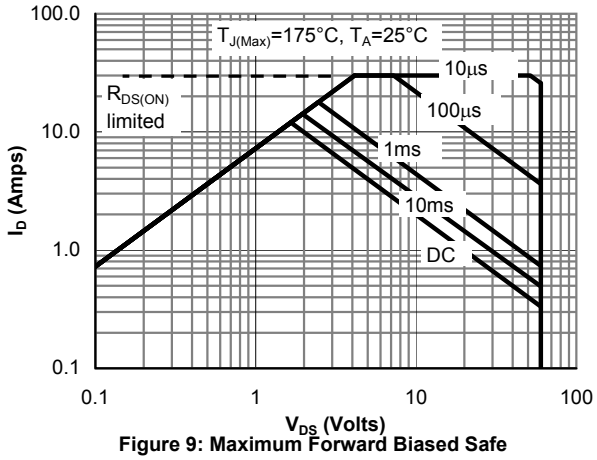


Figure 9: Maximum Forward Biased Safe Operating Area (Note F)

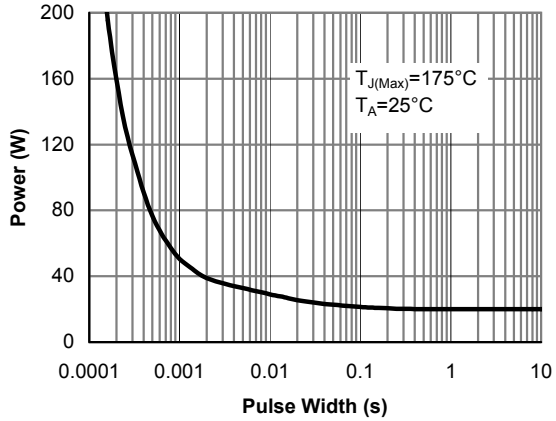


Figure 10: Single Pulse Power Rating Junction-to-Case (Note F)

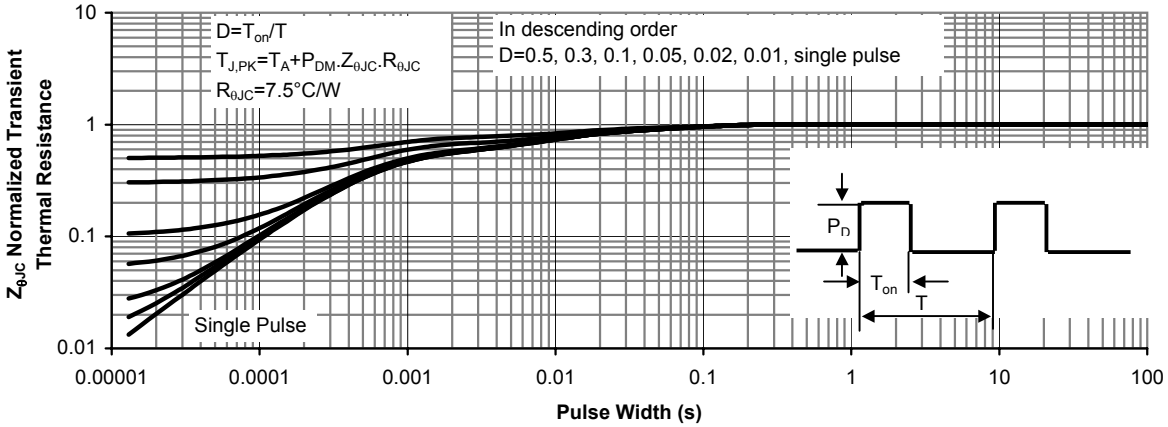


Figure 11: Normalized Maximum Transient Thermal Impedance (Note F)

TYPICAL ELECTRICAL AND THERMAL CHARACTERISTICS

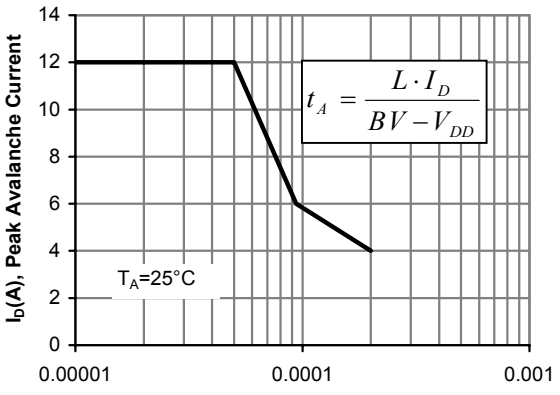


Figure 12: Single Pulse Avalanche capability

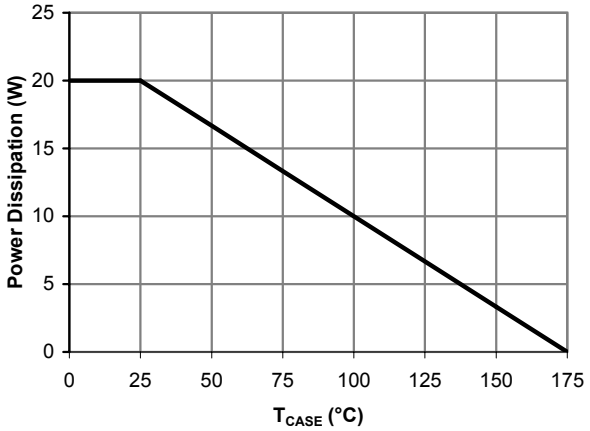


Figure 13: Power De-rating (Note B)

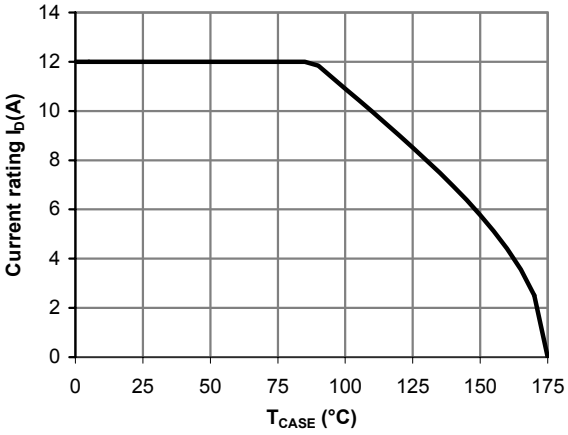
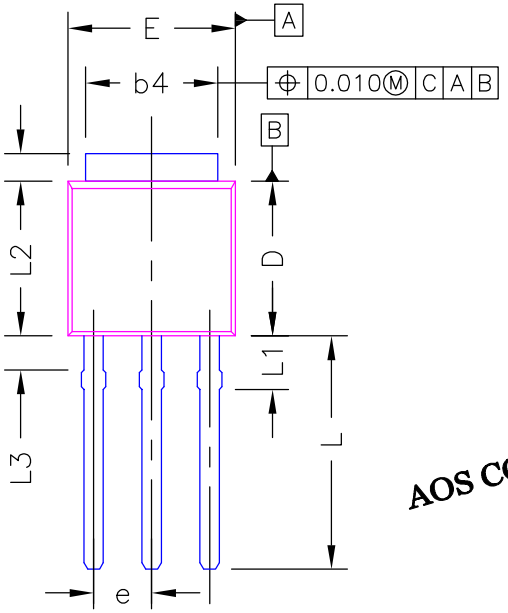
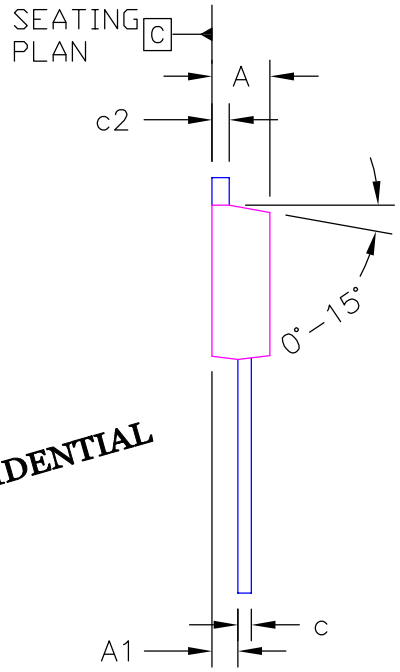
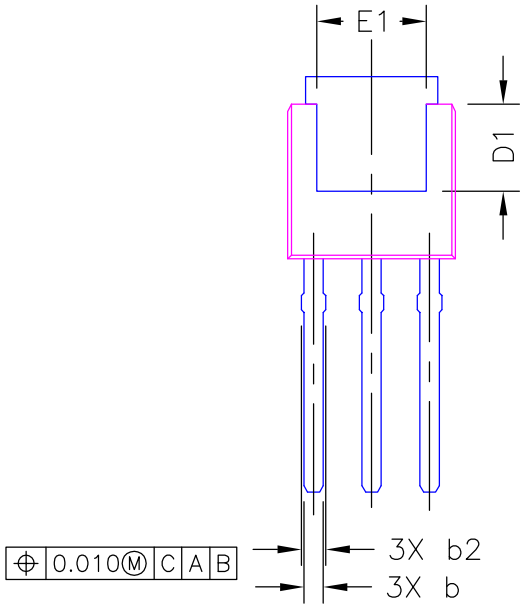


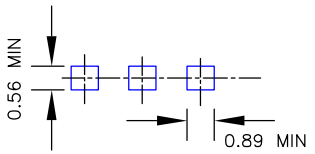
Figure 14: Current De-rating (Note B)







RECOMMENDATION OF HOLE PATTERN



UNIT: mm

SYMBOLS	DIMENSIONS IN MILLIMETERS			DIMENSIONS IN INCHES		
	MIN	NOM	MAX	MIN	NOM	MAX
A	2.24	2.29	2.39	0.088	0.090	0.094
A1	0.89	---	1.14	0.035	---	0.045
b	0.69	0.76	0.89	0.027	0.030	0.035
b2	0.89	---	1.14	0.035	---	0.045
b4	5.21	---	5.46	0.205	---	0.215
c	0.46	0.51	0.56	0.018	0.020	0.022
c2	0.48	---	0.58	0.019	---	0.023
D	5.97	6.10	6.22	0.235	0.240	0.245
D1	4.32	---	---	0.170	---	---
E	6.48	6.60	6.73	0.255	0.260	0.265
E1	4.32	---	5.33	0.170	---	0.210
e	2.29 BSC.			0.090 BSC.		
L	8.89	9.19	9.65	0.350	0.362	0.380
L1	1.91	2.11	2.29	0.075	0.083	0.090
L2	0.89	---	1.27	0.035	---	0.050
L3	1.14	1.35	1.52	0.045	0.053	0.060

NOTE
1. PACKAGE BODY SIZES EXCLUDE MOLD FLASH AND GATE BURRS.
2. TOLERANCE 0.100 MILLIMETERS UNLESS OTHERWISE SPECIFIED.
3. CONTROLLING DIMENSION IS MILLITER. CONVERTED INCH DIMENSIONS ARE NOT NECESSARILY EXACT.
4. REFER TO JEDEC TO-251D AA.

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES

DECIMAL: X.X ±, X.XX ±, X.XXX ±

ANGULAR: ±

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THIRD ANGLE PROJECTION

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Document No.	PD-00016
Version	rev B
Title	TO-251 PACKAGE OUTLINE

Document No.	PD-00247
Version	rev B
Title	AOU402 Marking Description

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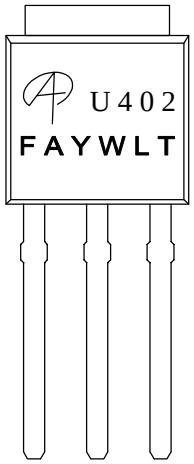
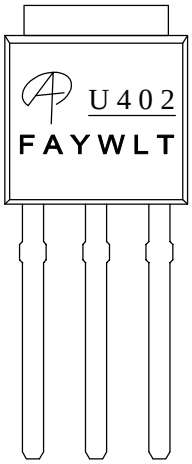
DPAK(TO-251) PACKAGE MARKING DESCRIPTION



Standard product



Green product

NOTE:
LOGO - AOS LOGO
U402 - PART NUMBER CODE.
F&A - FOUNDRY AND ASSEMBLY LOCATION
Y - YEAR CODE
W - WEEK CODE.
L T - ASSEMBLY LOT CODE

PART NO.	DESCRIPTION	CODE
AOU402	Standard product	U402
AOU402L	Green product	U402