UMW IRFR4105TR

55V N-Channel MOSFET

1.Description

- Ultra Low On-Resistance
- Fast Switching
- Fully Avalanche Rated
- Lead-Free

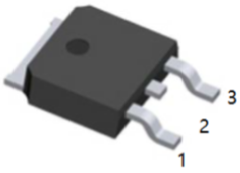
2.Features

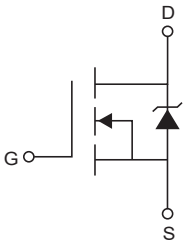
- $V_{DS\ (V)}$=55V
- I_D=27A
- $R_{DS(ON)}$<45mΩ(V_{GS}=10V)

3.Pinning information

Pin	Symbol	Description
1	G	GATE
3	S	SOURCE
2	D	DRAIN

TO-252(DPAK)
top view





4.Absolute Maximum Ratings

Parameter		Symbol	Rating	Units
Continuous Drain Current, V_{GS}=10V	T_C=25°C	I_D	27 ⑤	A
Continuous Drain Current, V_{GS}=10V	T_C=100°C		19	A
Pulsed Drain Current ①⑦		I_{DM}	100	A
Power Dissipation	T_C=25°C	P_D	68	W
Linear Derating Factor			0.45	W/°C
Gate-to-Source Voltage		V_{GS}	±20	V
Single Pulse Avalanche Energy ②⑦		E_{AS}	65	mJ
Avalanche Current ①⑦		I_{AR}	16	A
Repetitive Avalanche Energy ①⑦		E_{AR}	6.8	mJ
Peak Diode Recovery dv/dt ③		dv/dt	5	V/ns
Operating Junction and Storage Temperature Range		T_J, T_{STG}	-55 to 175	°C
Soldering Temperature, for 10 seconds			300 (1.6mm from case)	°C

5.Thermal resistance rating

Parameter	Symbol	Typ	Max	Units
Junction-to-Case	$R_{\theta JC}$		2.2	°C/W
Junction-to-Ambient (PCB Mount) **	$R_{\theta JA}$		50	°C/W
Junction-to-Ambient	$R_{\theta JA}$		110	°C/W

6.Electrical Characteristics @ T_J= 25°C (unless otherwise specified)

Parameter	Symbol	Conditions	Min	Typ	Max	Units
Drain-to-Source Breakdown Voltage	$V_{(BR)DSS}$	I_D=250μA, V_{GS}=0V	55			V
Breakdown Voltage Temp. Coefficient	$\Delta V_{(BR)DSS}/\Delta T_J$	I_D=1mA,Reference to 25°C		0.052		V/°C
Static Drain-to-Source On-Resistance	$R_{DS(ON)}$	V_{GS}=10V, I_D=16A ④		45		mΩ
Gate Threshold Voltage	$V_{GS(th)}$	V_{DS}=V_{GS}, I_D=250μA	2		4	V
Forward Transconductance	g_{FS}	V_{DS}=25V, I_D=16A ⑦	6.5			S
Drain-to-Source Leakage Current	I_{DSS}	V_{DS}=55V, V_{GS}=0V			25	μA
		V_{DS}=44V,V_{GS}=0V,T_J=150°C			250	μA
Gate-to-Source Forward Leakage	I_{GSS}	V_{GS}=20V			100	nA
Gate-to-Source Reverse Leakage		V_{GS}=-20V			-100	nA
Total Gate Charge	Q_g	I_D=16A			34	nC
Gate-to-Source Charge	Q_{gs}	V_{DS}=44V, V_{GS}=10V			6.8	nC
Gate-to-Drain ("Miller") Charge	Q_{gd}	See Fig.6 and 13 ④⑦			14	nC
Turn-On Delay Time	$t_{D(on)}$	V_{DD}=28V		7		ns
Rise Time	t_r	I_D=16A		49		ns
Turn-Off Delay Time	$t_{D(off)}$	R_G=18Ω, R_D=1.8Ω		31		ns
Fall Time	t_f	See Fig.10 ④⑦		40		ns
Internal Drain inductance	L_D	Between lead, 6mm (0.25in.)from package and center of die contact ⑥		4.5		nH
Internal Source inductance	L_S			7.5		nH
Input Capacitance	C_{iss}	V_{GS}=0V, V_{DS}=25V f=1MHz, See Fig. 5 ⑦		700		pF
Output Capacitance	C_{oss}			240		pF
Reverse Transfer Capacitance	C_{rss}			100		pF

Source-Drain Ratings and Characteristics						
Continuous Source Current (Body Diode)	I_S	MOSFET symbol showing the integral reverse p-n junction diode.			27⑤	A
Pulsed Source Current (Body Diode) ①⑦	I_{SM}				100	A
Diode Forward Voltage	V_{SD}	T_J=25°C, I_S=16A, V_{GS}=0V ④			1.6	V
Reverse Recovery Time	t_{rr}	T_J=25°C, I_F=16A dI/dt=100A/μs ④⑦		57	86	ns
Reverse Recovery Charge	Q_{rr}			130	200	nC
Forward Turn-On Time	t_{on}	Intrinsic turn-on time is negligible (turn-on is dominated by L_S+L_D)				

Notes:

① Repetitive rating; pulse width limited by max. junction temperature.(See fig.11)

② V_{DD}=25V, Starting T_J=25°C, L=410μH, R_G=25Ω, I_{AS}=16A.(See figure.12)

③ I_{SD} ≤ 16A, di/dt ≤420A/μs, V_{DD} ≤ $V_{(BR)DSS}$, T_J ≤ 175°C.

④ Pulse width ≤ 300μs; duty cycle ≤ 2%.

⑤ Calculated continuous current based on maximum allowable junction temperature; Package limitation current = 20A

7.1Typical Characterisitics

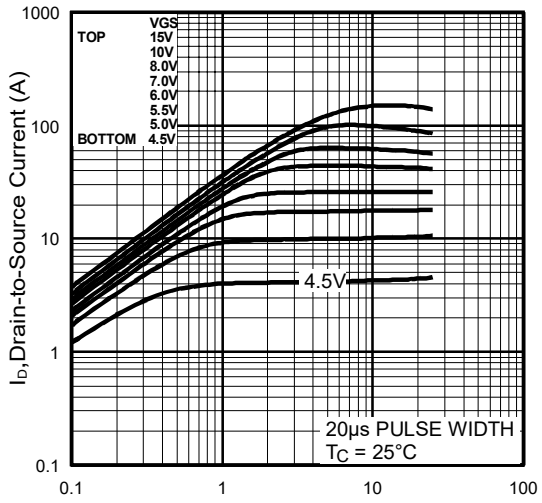


Figure 1: Typical Output Characteristics

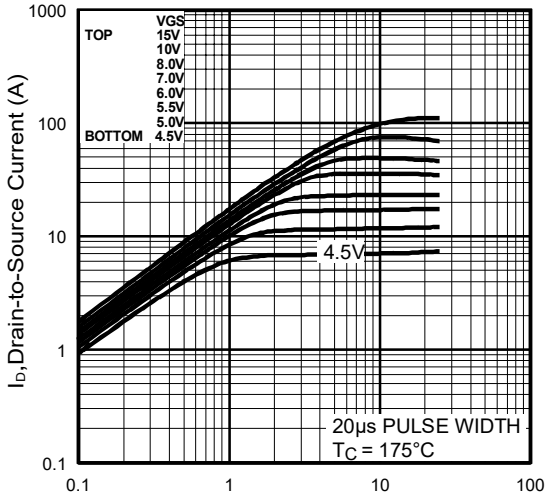


Figure 2: Typical Output Characteristics

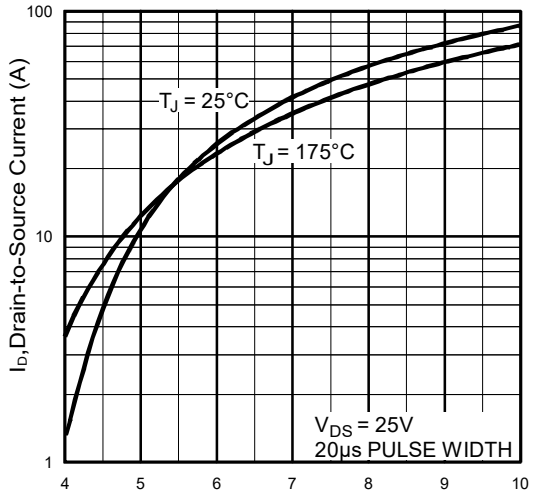


Figure 3: Typical Transfer Characteristics

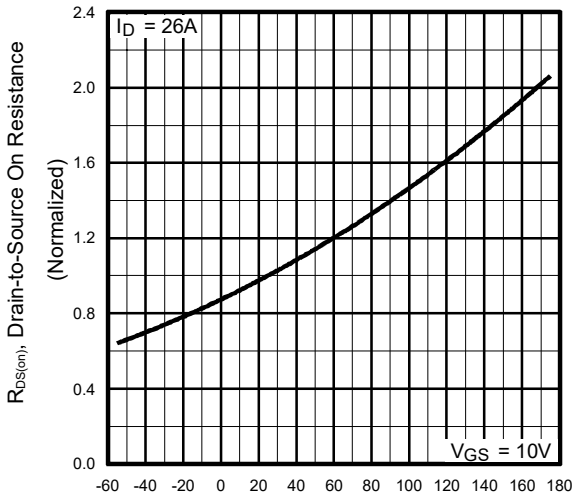
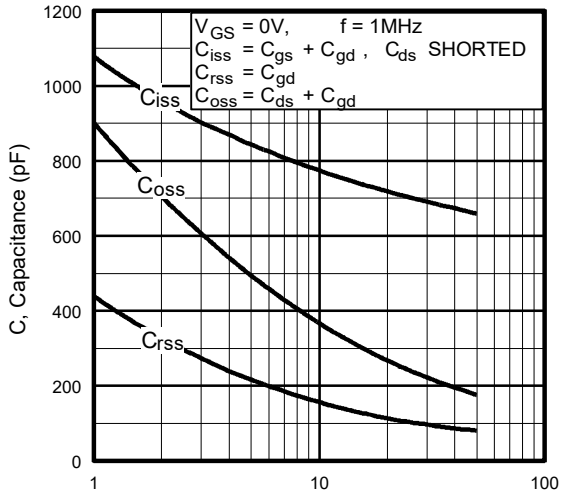


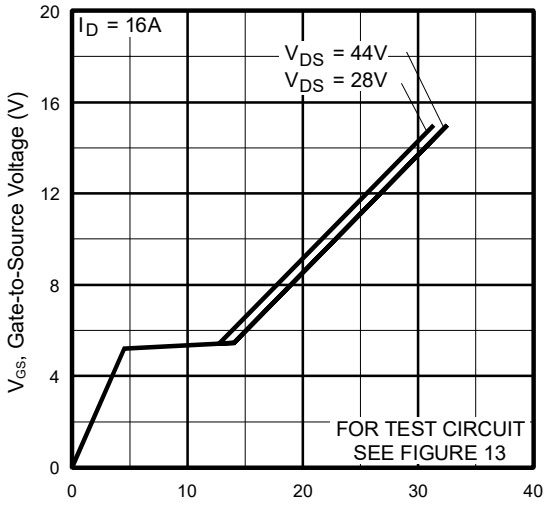
Figure 4: Nomalized On-ResistanceVs. Temperature

7.2Typical Characterisitics



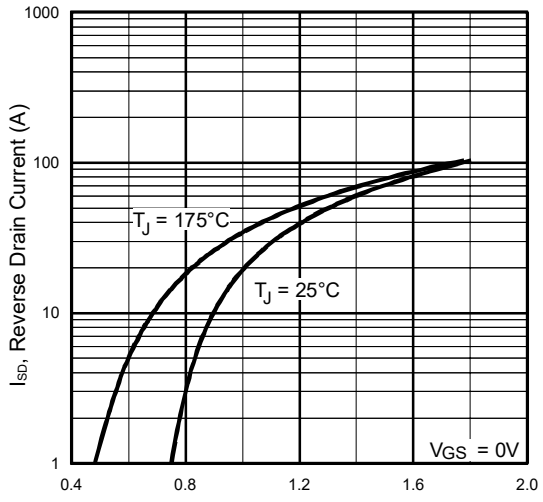
V_{DS} ,Drain-to-Source Voltage (V)

Figure 5: Typical Capacitance Vs. Drain-to-Source Voltage



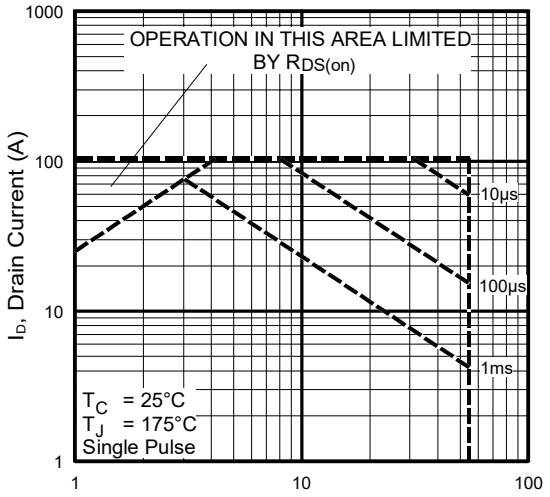
Q_G, Total Gate Charge (nC)

Figure 6: Typical Gate Charge Vs. Gate-to-Source Voltage



V_{SD}, Source-to-Drain Voltage (V)

Figure 7: Typical Source-Drain Diode Forward Voltage



V_{DS}, Drain-to-Source Voltage (V)

Figure 8: Maximum Safe Operating Area

7.3Typical Characterisitics

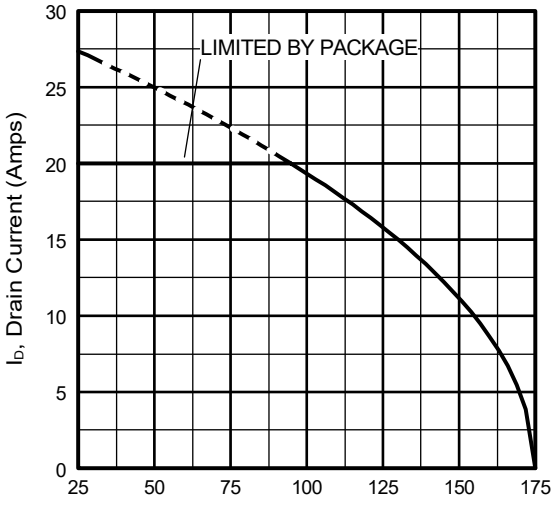


Figure 9: Maximum Drain Current Vs. Case Temperature

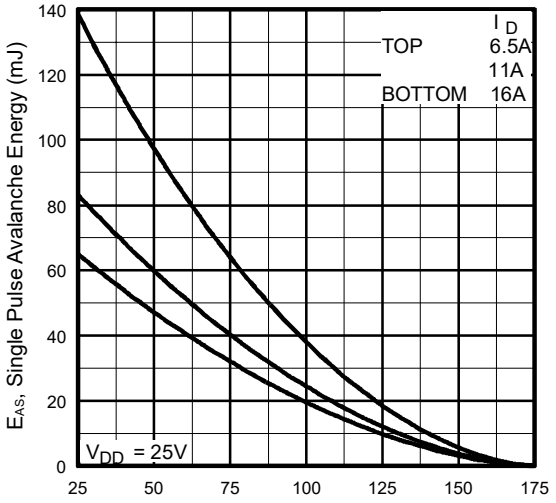


Figure 10: Maximum Avalanche Energy Vs. Drain Current

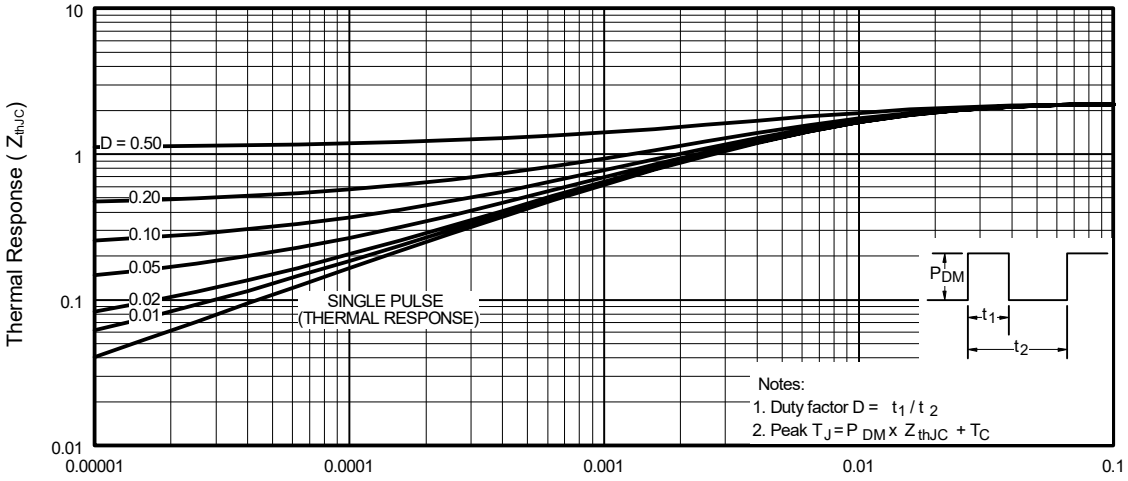


Figure 11: Maximum Effective Transient Thermal Impedance, Junction-to-Case

7.4Typical Characterisitics

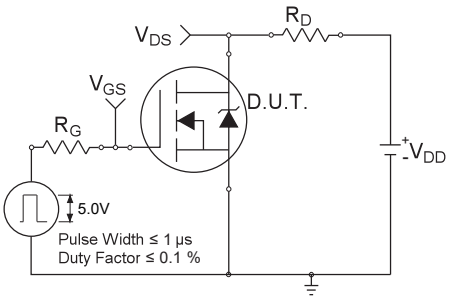


Figure 12a: Switching Time Test Circuit

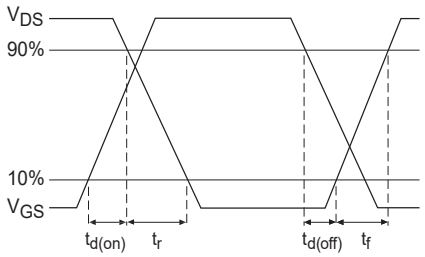


Figure 12b: Switching Time Waveforms

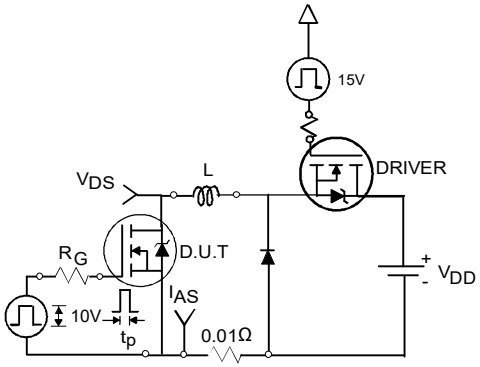


Figure 13a: Unclamped Inductive Test Circuit

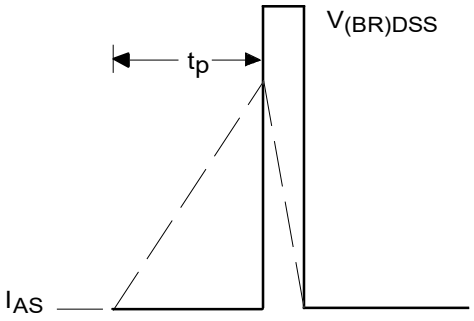


Figure 13b: Unclamped Inductive Waveforms

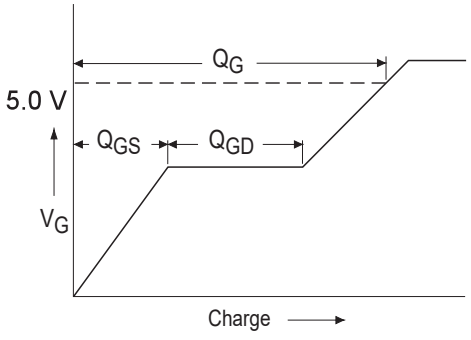


Figure 14a: Basic Gate Charge Waveform

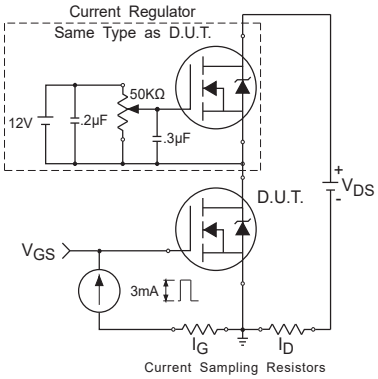
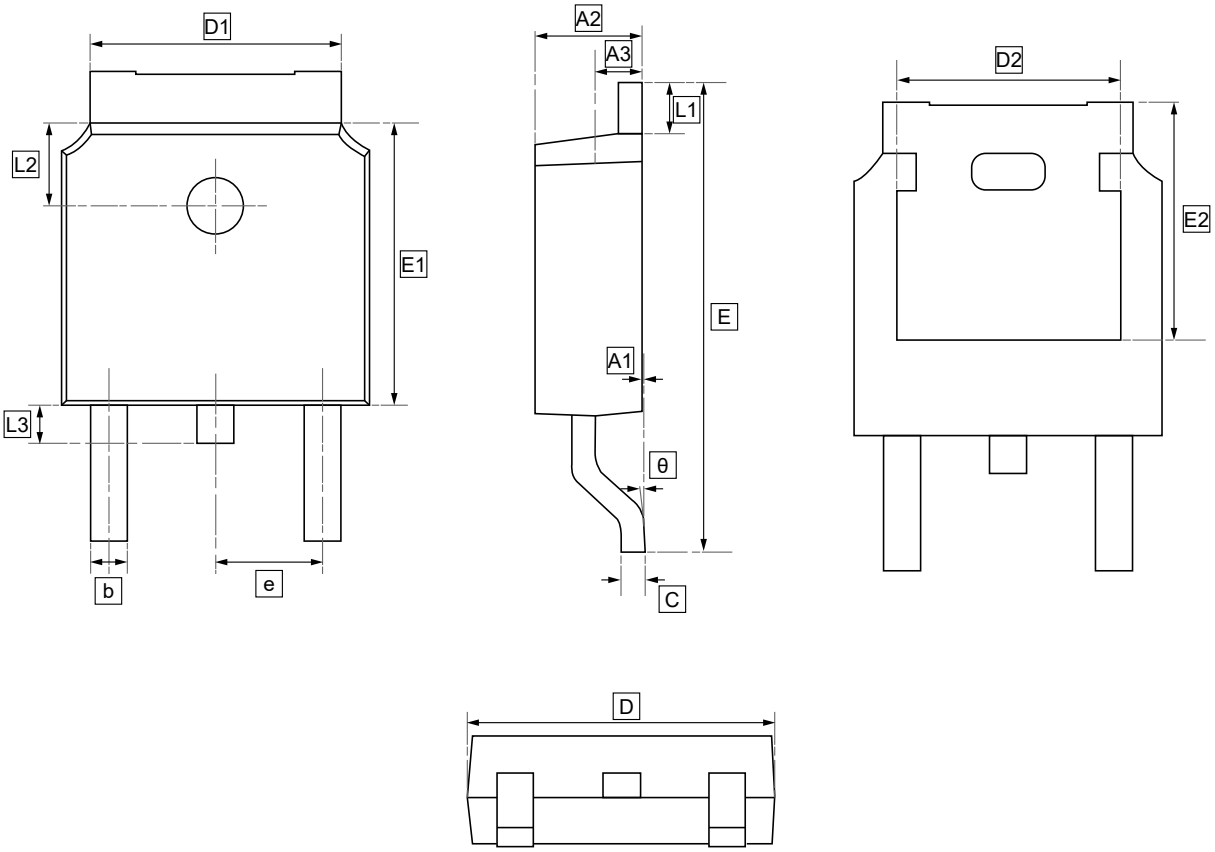


Figure 14b: Gate Charge Test Circuit

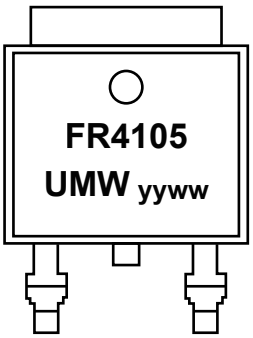
8.TO-252 Package Outline Dimensions



DIMENSIONS (mm are the original dimensions)

Symbol	A1	A2	A3	b	c	D	D1	D2	E	E1	E2	e	L1	L2	L3	θ
Min	0.00	2.18	0.90	0.65	0.46	6.35	4.95	4.32	9.40	5.97	5.21	2.286	0.89	1.70	0.60	0.00
Max	0.13	2.39	1.10	0.85	0.61	6.73	5.46	4.90	10.41	6.22	5.38	BSC	1.27	1.90	1.00	8.00

9.Ordering information



yy: Year Code
ww: Week Code

Order Code	Package	Base QTY	Delivery Mode
UMW IRFR4105TR	TO-252	2500	Tape and reel

10.Disclaimer

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