International
IOR Rectifier

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Datasheet No. – PD97438

IRS2053MPbF

3 CH Digital Audio Amplifier

Features

- 3 channel integrated analog input Class D audio amplifier drivers
- Versatile protection control enabling latched, non-latched, or host controlled shutdown function
- DC offset detection input
- Clipping detection
- Thermal sensor inputs
- Fault output
- Programmable over current protection
- Programmable dead-time generation
- Startup click noise reduction
- Under voltage protection
- High noise immunity
- RoHS compliant

Note

The IRS2053M digital audio driver is a three channel Class D audio driver housed in a 48 pin MLPQ. The IRS2053M features clipping detection outputs, DC offset detection input, over temperature sensor inputs and a fault reporting output.

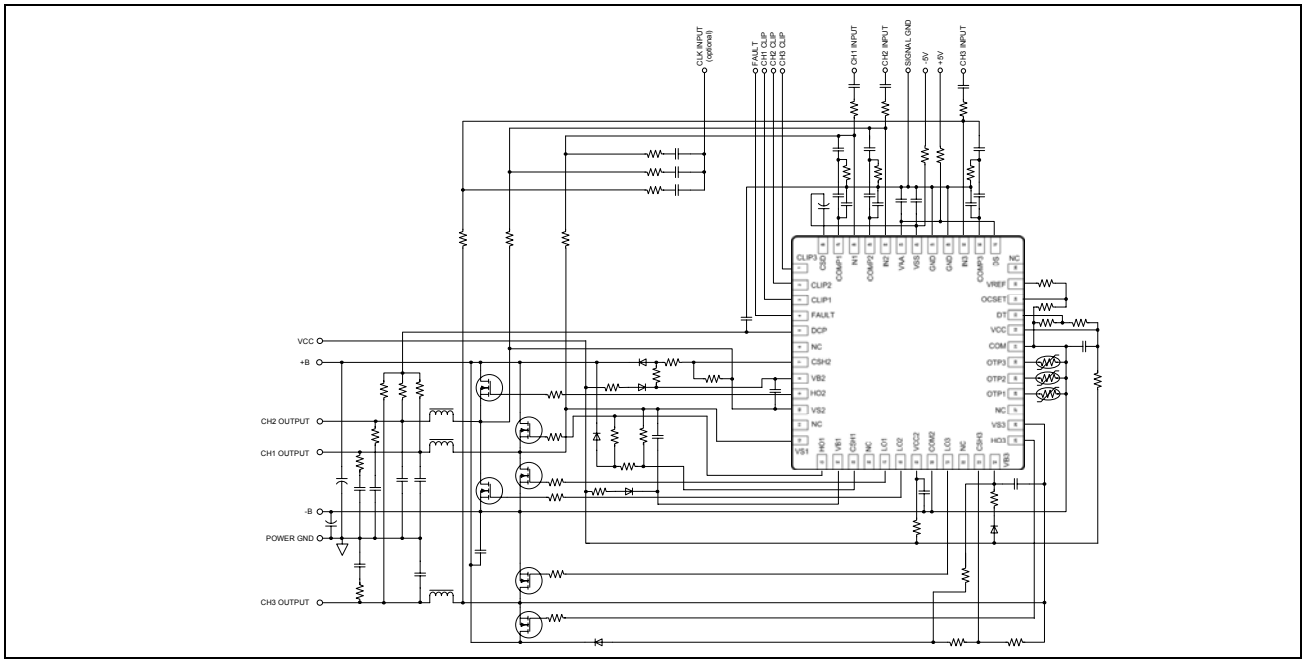
Product Summary

Topology	Half-Bridge
$V_{OFFSET\ (max)}$	+/- 100 V
I_{O+} & I_{O-} (typical)	0.5 A & 0.6 A
Selectable deadtime	45/65/85/105 ns
DC offset	<20 mV
Error amplifier open loop gain	>60 dB

Package

MLPQ48 (7x7 mm, 0.50 mm pitch)

Typical Connection



Description

The IRS2053 integrates three channels of high voltage, high performance Class D audio amplifier drivers with PWM modulators and protections. In conjunction with external MOSFET and external components, a complete 3 channel Class D audio amplifier can be realized. The IRS2053 is designed with floating analog inputs and protection control interface pin especially for half bridge topology. High and low side MOSFET are protected from over current conditions by a programmable bi-directional current sensing. Essential elements of PWM modulator section allow flexible system design. A small MLPQ48 package enhances the benefit of smaller size of Class D topology.

Qualification Information†

Qualification Level		Industrial††
		Comments: This family of ICs has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.
Moisture Sensitivity Level		MSL2†††, 260°C (per IPC/JEDEC J-STD-020)
ESD	**Machine Model**	Class A (per JEDEC standard EIA/JESD22-A115)
	Human Body Model	Class 1C (per EIA/JEDEC standard JESD22-A114)
IC Latch-Up Test		Class I, Level A (per JESD78A)
RoHS Compliant		Yes

† Qualification standards can be found at International Rectifier's web site http://www.irf.com/

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

Absolute Maximum Ratings

Absolute Maximum Ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM; all currents are defined positive into any lead. The Thermal Resistance and Power Dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition	Min.	Max.	Units
V_{Bn}	High side floating supply voltage	-0.3	215	V
V_{Sn}	High side floating supply voltage††, n=1-3	V_{Bn} -15	V_{Bn} +0.3	V
V_{Hon}	High side floating output voltage, n=1-3	V_{Sn} -0.3	V_{Bn} +0.3	V
V_{CSHn}	CSH pin input voltage, n=1-3	V_{Sn} -0.3	V_{Bn} +0.3	V
V_{CCn}	Low side fixed supply voltage††, n=1-2	-0.3	20	V
V_{LOn}	Low side output voltage, n=1-3	-0.3	VCC2 +0.3	V
V_{AA}	Floating input positive supply voltage††	(See I_{AAZ})	210	V
V_{SS}	Floating input negative supply voltage††	-1 (See I_{SSZ})	GND +0.3	V
V_{GND}	Floating input supply ground voltage	V_{SS} -0.3 (See I_{SSZ})	V_{AA} +0.3 (See I_{AAZ})	V
COM2	Low side output supply return	-0.3	+0.3	V
I_{IN-n}	Inverting input current †, n=1-3	-	±3	mA
V_{CSD}	SD pin input voltage	V_{SS} -0.3	V_{AA} +0.3	V
V_{COMPn}	COMP pin input voltage, n=1-3	V_{SS} -0.3	V_{AA} +0.3	V
V_{DS}	DS pin input voltage	V_{SS} -0.3	V_{AA} +0.3	V
V_{CLIPn}	CLIP pin input voltage	V_{SS} -0.3	V_{AA} +0.3	V
I_{CLIPn}	CLIP pin sinking current	-	5	mA
V_{FAULT}	FAULT pin input voltage	V_{SS} -0.3	V_{AA} +0.3	V
I_{FAULT}	FAULT pin sinking current	-	5	mA
V_{DCP}	DCP pin input voltage	(See I_{DCP})	(See I_{DCP})	V
I_{DCP}	DCP pin sinking/sourcing current	-1	1	mA
V_{DT}	DT pin input voltage	-0.3	V_{CC} +0.3	V
V_{OCSET}	OCSET pin input voltage	-0.3	V_{CC}+0.3	V
V_{OTPn}	OTP pin input voltage	-0.3	V_{CC} +0.3	V
I_{AAZ}	Floating input positive supply zener clamp current	-	20	mA
I_{SSZ}	Floating input negative supply zener clamp current	-	20	mA
I_{CCZn}	Low side supply zener clamp current†††, n=1-2	-	10	mA
I_{BSZn}	Floating supply zener clamp current†††, n=1-3	-	10	mA
I_{OREF}	Reference output current	-	5	mA
dV_{Sn}/dt	Allowable Vs voltage slew rate, n=1-3	-	50	V/ns
dV_{SS}/dt	Allowable Vss voltage slew rate†††	-	50	V/ms

Absolute Maximum Ratings (cont'd)

Symbol	Definition	Min.	Max.	Units
Pd	Maximum power dissipation @ $T_A \leq +25°C$	-	6.2	W
Rth_{JA}	Thermal resistance, Junction to ambient††††	-	20	°C/W
Rth_{JC}	Thermal resistance, Junction to case	-	3	°C/W
T_J	Junction Temperature	-	150	°C
T_S	Storage Temperature	-55	150	°C
T_L	Lead temperature (Soldering, 10 seconds)	-	300	°C

† IN-1-3 contains clamping diode to GND.
†† VAA-VSS, Vcc1-COM, Vcc2-COM2, VB1-VS1, VB2-VS2 and VB3-VS3 contain internal shunt zener diodes. Please note that the voltage ratings of these can be limited by the clamping current.
††† For the rising and falling edges of step signal of 10V. Vss=15V to 200V.
†††† According to JESD51-5. JEDEC still air chamber.

Recommended Operating Conditions

For proper operation, the device should be used within the recommended conditions below. The Vs and COM offset ratings are tested with supplies biased at V_{AA}-V_{SS}=10V, V_{CC}=12V and V_B-V_S=12V. All voltage parameters are absolute voltages referenced to COM; all currents are defined positive into any lead.

Symbol	Definition	Min.	Max.	Units
V_{Bn}	High side floating supply absolute voltage, n=1-3	V_{Sn} +10	V_{Sn} +14	V
V_{Sn}	High side floating supply offset voltage	†	200	V
I_{AAZ}	Floating input positive supply zener clamp current	1	11	mA
I_{SSZ}	Floating input negative supply zener clamp current	1	11	mA
V_{SS}	Floating input supply absolute voltage	0	200	V
V_{HOn}	High side floating output voltage, n=1-3	Vs	V_B	V
V_{CC}	Low side fixed supply voltage	10	15	V
V_{LOn}	Low side output voltage, n=1-3	0	V_{CC}2	V
V_{GND}	GND pin input voltage	V_{SS} †††	V_{AA} †††	V
V_{IN-n}	Inverting input voltage, n=1-3	V_{GND} -0.5	V_{GND} +0.5	V
V_{CSD}	CSD pin input voltage	V_{SS}	V_{AA}	V
V_{COMPn}	COMP pin input voltage, n=1-3	V_{SS}	V_{AA}	V
C_{COMPn}	COMP pin phase compensation capacitor to GND, n=1-3	1	-	nF
V_{DT}	DT pin input voltage	0	V_{CC}	V
I_{OREF}	Reference output current to COM ††	0.3	0.8	mA
V_{OCSET}	OCSET pin input voltage	0.5	5	V
V_{CSHn}	CSH pin input voltage, n=1-3	V_{Sn}	V_{Bn}	V
dVss/dt	Allowable Vss voltage slew rate upon power-up ††††	-	50	V/ms
f_{SW}	Switching Frequency	-	800	kHz
T_A	Ambient Temperature	-40	125	°C

† Logic operational for Vsn equal to –5V to +200V. Logic state held for Vsn equal to –5V to $–V_{BSn}$.
†† Nominal voltage for V_{REF} is 5.1V. I_{OREF} of 0.3 – 0.8mA dictates total external resistor value on VREF to be 6.3k to 16.7k ohm.
††† GND input voltage is limited by I_{IN-n}.
†††† Vss ramps up from 0V to 200V.

Electrical Characteristics

V_{CC}=Vcc2=V_{BS1}=V_{BS2}=V_{BS3}=12V, V_{SS}=V_{S1}=V_{S2}=V_{S3}=COM=0V, V_{GND}=5V, V_{AA}=10V, C_L=1nF and T_A=25°C unless otherwise specified.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Low Side Supply 1						
UV_{CC+}	Vcc supply UVLO positive threshold	8.4	8.9	9.4	V	
UV_{CC-}	Vcc supply UVLO negative threshold	8.2	8.7	9.2	V	
UV_{CCHYS}	UV_{CC} hysteresis	-	0.2	-	V	
I_{QCC}	Low side quiescent current	-	5	8	mA	V_{DT}=V_{CC}
$V_{CLAMPL1}$	Low side zener diode clamp voltage	19.0	20.4	21.6	V	I_{CC1}=10mA
Low Side Supply 2						
I_{QCC2}	Low side quiescent current	-	4.2	8	mA	
$V_{CLAMPL2}$	Low side zener diode clamp voltage	19.6	20.4	21.6	V	I_{CC2}=10mA
High Side Floating Supply						
UV_{BS+n}	High side well UVLO positive threshold, n=1-3	8.0	8.5	9.0	V	
UV_{BS-n}	High side well UVLO negative threshold, n=1-3	7.8	8.3	8.8	V	
UV_{BSHYSn}	UV_{BS} hysteresis, n=1-3	-	0.2	-	V	
I_{QBSn}	High side quiescent current, n=1-3	-	0.5	1	mA	
I_{LKHn}	High to Low side leakage current, n=1-3	-	-	50	µA	V_{Bn}=V_{Sn} =200V
$V_{CLAMPHn}$	High side zener diode clamp voltage, n=1-3	14.7	15.3	16.2	V	I_{BSn}=5mA
Floating Input Supply						
UV_{AA+}	VA+, VA- floating supply UVLO positive threshold from V_{SS}	8.2	8.7	9.2	V	GND pin floating
UV_{AA-}	VA+, VA- floating supply UVLO negative threshold from V_{SS}	7.7	8.2	8.7	V	GND pin floating
UV_{AAHYS}	UV_{AA} hysteresis	-	0.5	-	V	GND pin floating
I_{QAA0}	Floating Input positive quiescent supply current in shutdown mode	-	1	3	mA	V_{CSD} =VSS
I_{QAA10}	Floating Input positive quiescent supply current, positive input	-	12	25	mA	V_{IN-} = VSS+5.2V
I_{QAA11}	Floating Input positive quiescent supply current, negative input	-	9	20	mA	V_{IN-} = VSS+4.8V
I_{QAA2}	Floating Input positive quiescent supply current in start-up mode	-	20	35	mA	V_{CSD} =VSS+5.0V
I_{LKM}	Floating input side to Low side leakage current	-	-	50	µA	V_{AA}=V_{SS}=V_{GND}= 100V
V_{CLAMPM}	Floating supply zener diode clamp voltage	19.6	20.4	21.6	V	I_{AA}=5mA, V_{CSD} =VSS

Electrical Characteristics (cont'd)

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Audio Input (V_{GND}=0, V_{AA}=5V, V_{SS}=-5V, COM=COM2=VCC=VCC2=-5V, VS1=VS2=VS3=-5V, CSH1=CSH2=CHS3=-5V, DT=OCSET=-5V)						
V_{OSn}	CHn input offset voltage, n=1-3	-18	0	18	mV	
I_{BINn}	CHn input bias current, n=1-3	-	-	40	nA	
GBWn	CHn small signal bandwidth	-	9	-	MHz	C_{COMPn}=1nF, Rfn=0
V_{COMPn}	CHn OTA Output voltage, n=1-3	VAA-1	-	VSS+1	V	
g_{mn}	CHn OTA transconductance, n=1-3	-	100	-	mS	V_{IN-n}=10mV
G_{Vn}	CHn OTA gain, n=1-3	60	-	-	dB	
V_{Nrmsn}	CHn OTA input noise voltage, n=1-3	-	250	-	mVrms	BW=20kHz, Resolution BW=22Hz Fig.5
SRn	CHn slew rate, n=1-3	-	±5	-	V/us	C_{COMPn}=1nF
CMRRn	CHn common-mode rejection ratio, n=1-3	-	60	-	dB	
PSRRn	CHn supply voltage rejection ratio, n=1-3	-	65	-	dB	
$Vth+_{CLIPn}$	CHn clip detection positive threshold, n=1-3	0.85xV_{AA}	0.90xV_{AA}	0.95xV_{AA}	V	
$Vth-_{CLIPn}$	CHn clip detection negative threshold, n=1-3	0.05xV_{AA}	0.10xV_{AA}	0.15xV_{AA}	V	
t_{CLIPn}	CHn clipping detection propagation delay, n=1-3	-	40	-	ns	
$t_{CLIPmin}$	CHn clipping detection minimum output duration	-	3	-	us	
PWM comparator						
Vth_{PWM}	PWM comparator threshold in COMP	-	(V_{AA} - V_{SS})/2	-	V	
f_{OTAn}	CHn COMP pin star-up local oscillation frequency, n=1-3	0.6	1.0	-	MHz	V_{CSD} =VSS+5V

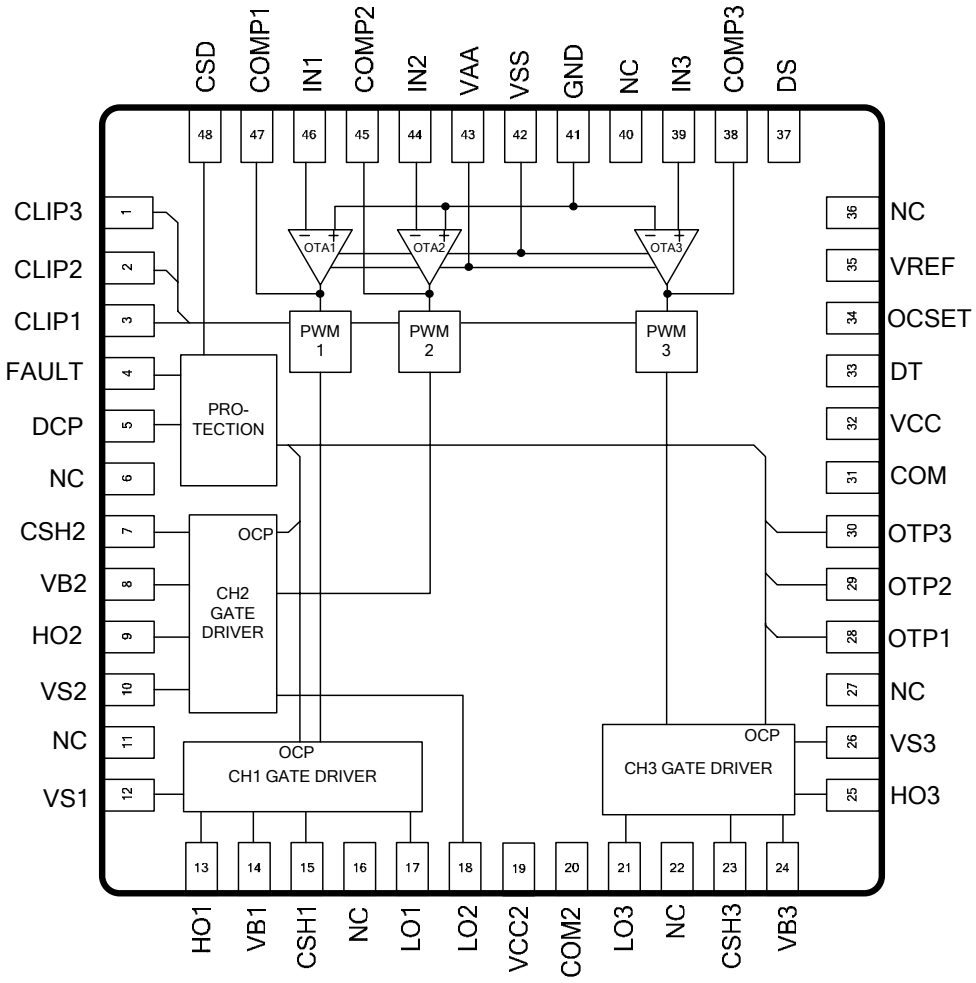
Electrical Characteristics (cont'd)

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Protection						
V_{REF}	Reference output voltage	4.8	5.1	5.4	V	I_{OREF} =0.5mA
Vth_{OCLn}	CHn low side OC threshold in Vsn, n=1-3	1.1	1.2	1.3	V	OCSET=1.2V
Vth_{OCHn}	CHn high side OC threshold in V_{CSHn}, n=1-3	1.1+ Vs	1.2+ Vs	1.3+ Vs	V	Vs=200V
V_{DCP+}	DCP pin positive detecting threshold		1.3		V	
V_{DCP-}	DCP pin negative detecting threshold		-1.3		V	
V_{DCPZ+}	DCP pin positive clamping voltage		3.0		V	
V_{DCPZ-}	DCP pin negative clamping voltage		-2.5		V	
V_{OTPn}	CHn OTP pin threshold, n=1-3		2.8		V	
I_{OTPn}	CHn OTP bias sourcing current, n=1-3		0.6		mA	OTPn=0V
V_{CSDH}	CSD pin shutdown release threshold	$0.62xV_{AA}$	$0.70xV_{AA}$	$0.78xV_{AA}$	V	
V_{CSDL}	CSD pin self reset threshold	$0.26xV_{AA}$	$0.30xV_{AA}$	$0.34xV_{AA}$	V	
I_{CSD+}	CSD pin discharge current	70	100	130	µA	$V_{CSD} = V_{SS}$ +5V
I_{CSD-}	CSD pin charge current	70	100	130	µA	$V_{CSD} = V_{SS}$ +5V
t_{SDn}	CHn shutdown propagation delay from $V_{CSD} > V_{SS} + Vth_{OCH}$ to Shutdown	-	-	250	ns	
t_{OCHn}	CHn propagation delay time from $V_{CSHn} > Vth_{OCHn}$ to Shutdown, n=1-3	-	-	500	ns	Fig.4
t_{OCLn}	CHn propagation delay time from Vsn> Vth_{OCL} to Shutdown, n=1-3	-	-	500	ns	Fig.3
$t_{OCLFAULT}$	CH1 propagation delay time from Vs1> Vth_{OCL} to FAULT	-	285	-	ns	

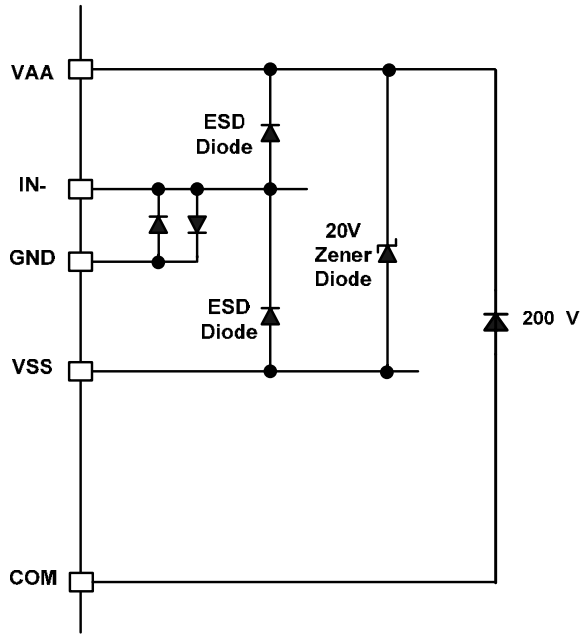
Electrical Characteristics (cont'd)

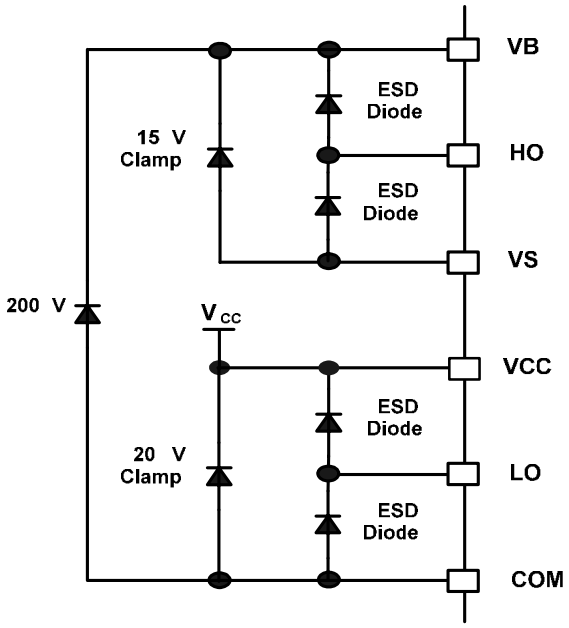
Symbol	Definition	Min	Typ	Max	Units	Test Conditions
Gate Driver						
Io+n	CHn output high short circuit current (Source) , n=1-3	-	0.5	-	A	Vo=0V, PW≤10µS
Io-n	CHn output low short circuit current (Sink) , n=1-3	-	0.6	-	A	Vo=12V, PW≤10µS
V_{OLn}	CHn low level out put voltage LO – COM, HO - VS, n=1-3	-	-	0.1	V	Io=0A
V_{OHn}	CHn high level out put voltage VCC – LO, VB - HO, n=1-3	-	-	1.4	V	
Ton0n	CHn high and low side turn-on propagation delay, n=1-3	-	350	-	ns	$V_{DT} = V_{CC}$, $V_{DS}=V_{AA}$
Toff0n	CHn high and low side turn-off propagation delay, n=1-3	-	325	-	ns	
Ton1n	CHn high and low side turn-on propagation delay, n=1-3	-	145	-	ns	$V_{DT} = V_{CC}$, $V_{DS}=V_{SS}$
Toff1n	CHn high and low side turn-off propagation delay, n=1-3	-	100	-	ns	
tr	Turn-on rise time	-	25	50	ns	
tf	Turn-off fall time	-	20	40	ns	
DT1n	CHn deadtime: LOn turn-off to HOn turn-on (DT_{LO-HO}) & HOn turn-off to LnO turn-on (DT_{HO-LO})	30	45	60	ns	$V_{DT}>V_{DT1,}$
DT2n	CHn deadtime: LOn turn-off to HOn turn-on (DT_{LO-HO}) & HOn turn-off to LOn turn-on (DT_{HO-LO})	45	65	85	ns	$V_{DT1}>V_{DT}> V_{DT2,}$
DT3n	CHn deadtime: LOn turn-off to HOn turn-on (DT_{LO-HO}) & HOn turn-off to LOn turn-on (DT_{HO-LO})	60	85	110	ns	$V_{DT2}>V_{DT}> V_{DT3,}$
DT4n	CHn deadtime: LOn turn-off to HOn turn-on (DT_{LO-HO}) & HO turn-off to LOn turn-on (DT_{HO-LO})$V_{DT}= V_{DT4}$	80	105	145	ns	$V_{DT}<V_{DT3}$
V_{DT1}	DT mode select threshold 1	0.51xVcc	0.57xVcc	0.63xVcc	V	
V_{DT2}	DT mode select threshold 2	0.32xVcc	0.36xVcc	0.40xVcc	V	
V_{DT3}	DT mode select threshold 3	0.21xVcc	0.23xVcc	0.25xVcc	V	
Vth_{DS}	DS pin input threshold	$0.4xV_{AA}$	$0.5xV_{AA}$	$0.6xV_{AA}$	V	V_{SS} =0V

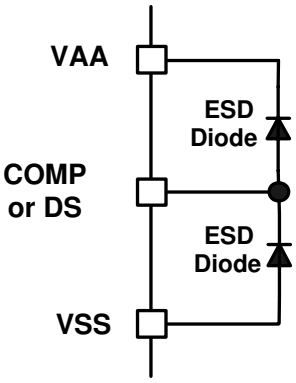
Functional Block Diagram

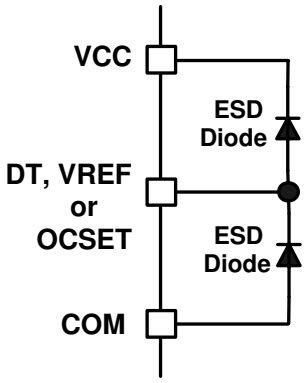


Input/Output Pin Equivalent Circuit Diagrams

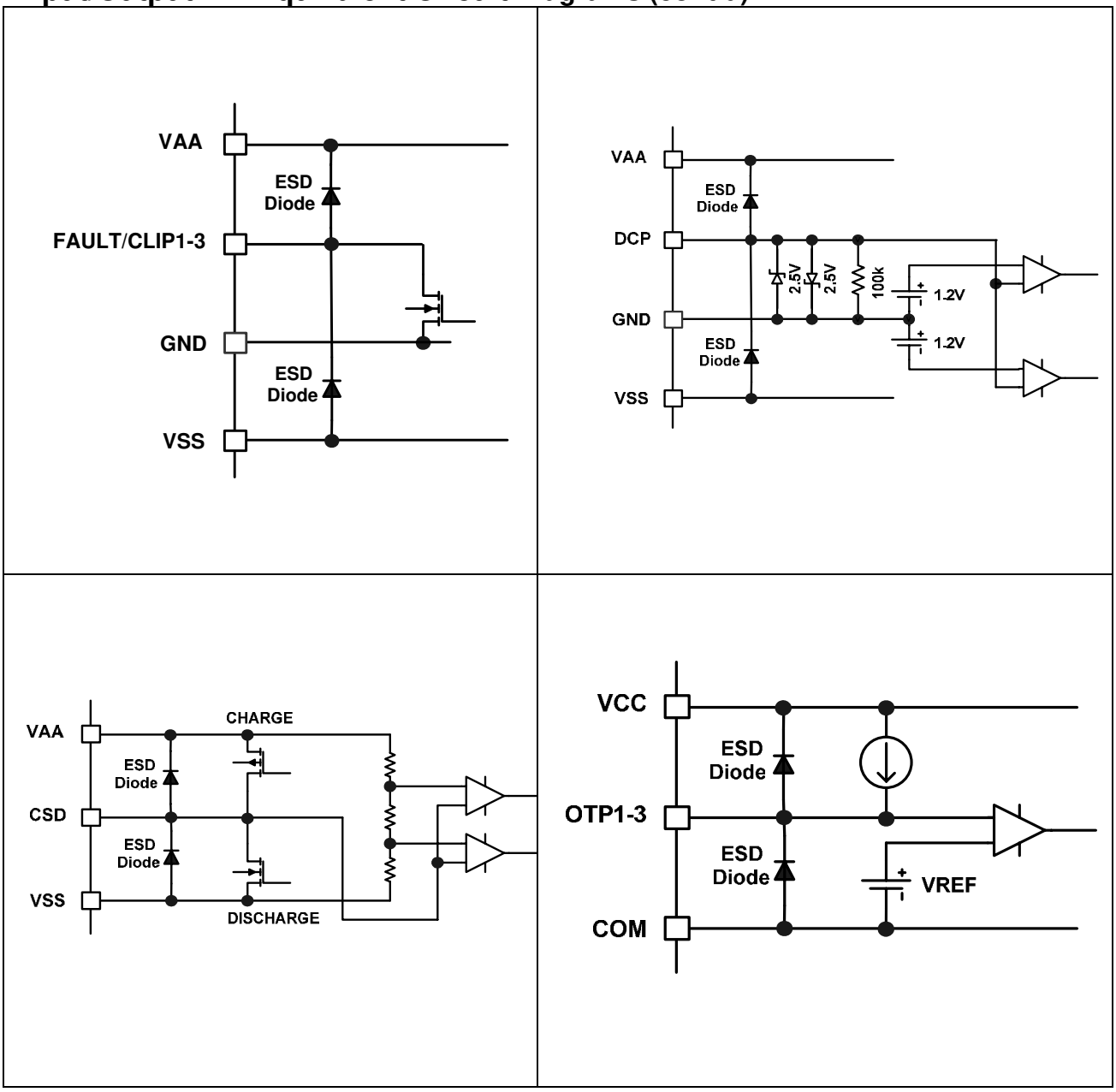








Input/Output Pin Equivalent Circuit Diagrams (cont'd)

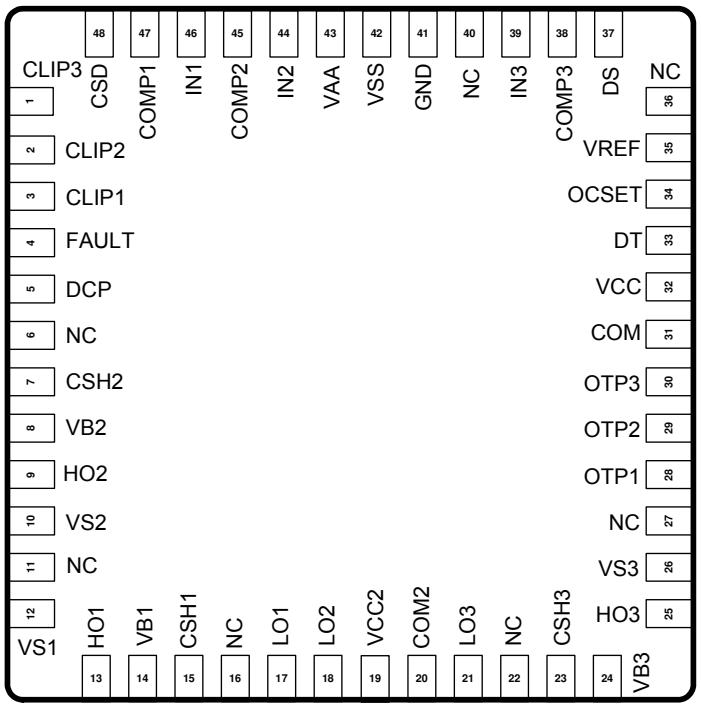


Lead Definitions

Pin #	Symbol	Description
1	CLIP3	Clipping detection output CH1, open drain, referenced to GND
2	CLIP2	Clipping detection output CH2, open drain, referenced to GND
3	CLIP1	Clipping detection output CH3, open drain, referenced to GND
4	FAULT	Fault output, open drain, referenced to GND
5	DCP	DC offset protection input
6	NC	
7	CSH2	CH2 High side over current sensing input, referenced to VS2
8	VB2	CH2 High side floating supply
9	HO2	CH2 High side output
10	VS2	CH2 High side floating supply return
11	NC	
12	VS1	CH1 High side floating supply return
13	HO1	CH1 High side output
14	VB1	CH1 High side floating supply
15	CSH1	CH1 High side over current sensing input, referenced to VS1
16	NC	
17	LO1	CH1 Low side output
18	LO2	CH2 Low side output
19	VCC2	Low side gate drive supply
20	COM2	Low side gate drive supply return
21	LO3	CH3 Low side output
22	NC	
23	CSH3	CH3 High side over current sensing input, referenced to VS3
24	VB3	CH3 High side floating supply

Pin #	Symbol	Description
25	HO3	CH3 High side output
26	VS3	CH3 High side floating supply return
27	NC	
28	OTP1	Over temperature sensor input 1
29	OTP2	Over temperature sensor input 2
30	OTP3	Over temperature sensor input 3
31	COM	Low side gate drive supply return
32	VCC	Low side gate drive supply
33	DT	Deadtime program, reference to COM
34	OCSET	Low side OCP threshold, referenced to COM
35	VREF	5.1V reference voltage output for OCSET
36	NC	
37	DS	Propagation delay select (VAA: Normal, VSS: Shorter)
38	COMP3	CH3 PWM comparator input
39	IN3	CH3 inverting audio input
40	NC	
41	GND	Input reference GND
42	VSS	Floating input negative supply
43	VAA	Floating input positive supply
44	IN2	CH2 inverting audio input
45	COMP2	CH2 PWM comparator input
46	IN1	CH1 inverting audio input
47	COMP1	CH1 PWM comparator input
48	CSD	Protection timer capacitor

Lead Assignments



Application Information and Additional Details

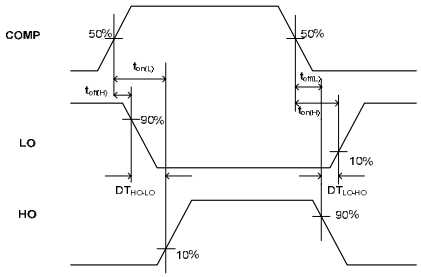


Figure 1 Switching Time Waveform Definitions

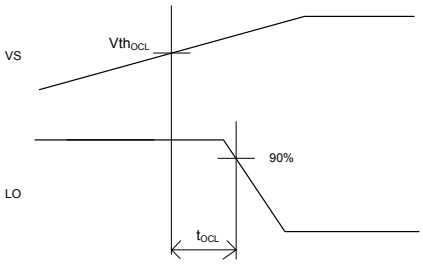


Figure 3 V_S > Vth_{OCL} to Shutdown Waveform

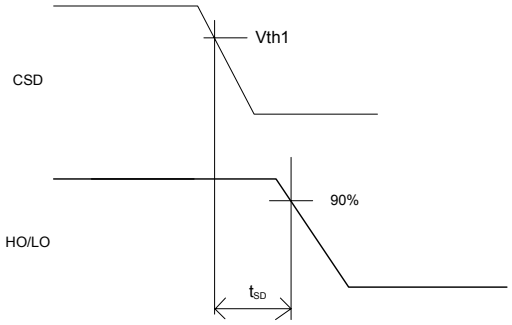


Figure 2 CSD to Shutdown Waveform Definitions

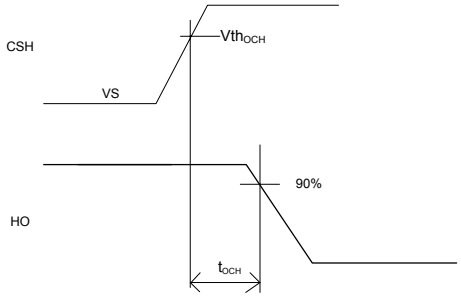


Figure 4 V_{CSH} > Vth_{OCH} to Shutdown Waveform

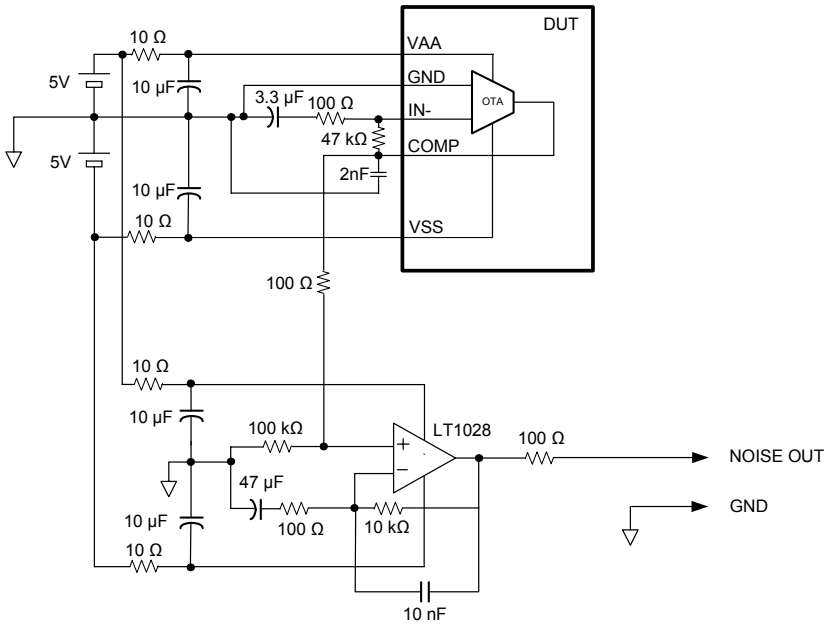
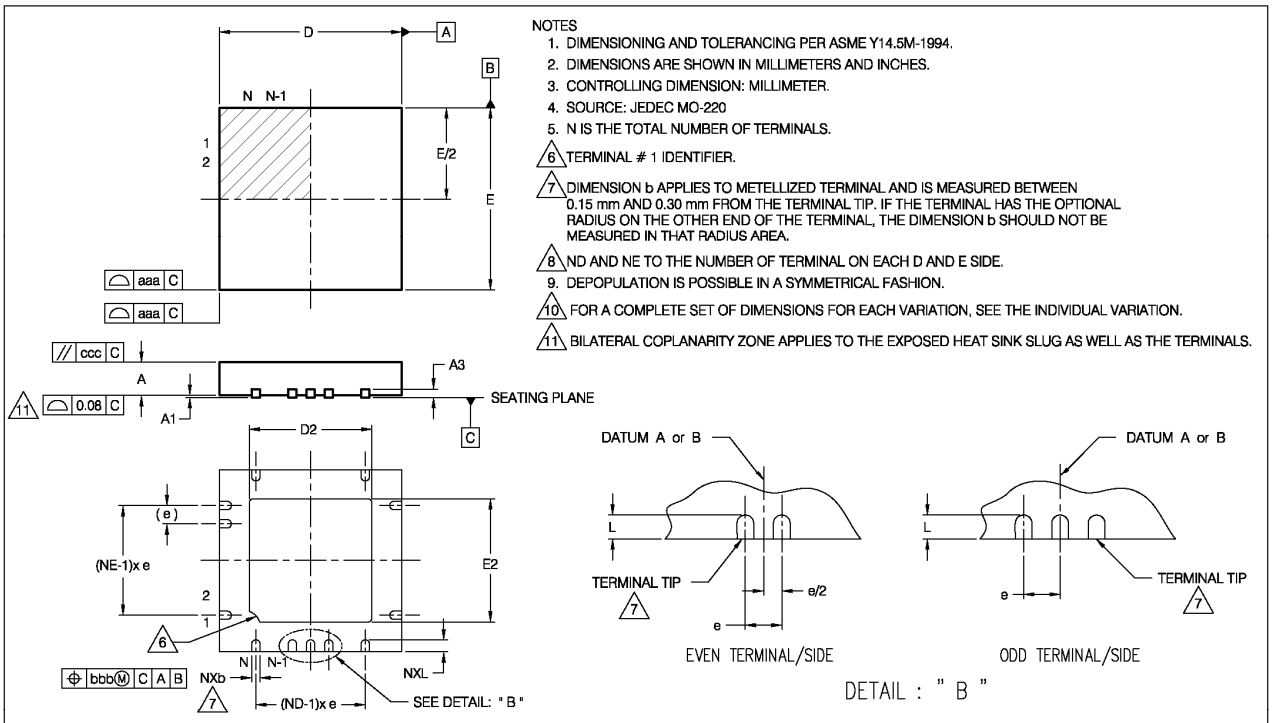


Figure 5: OTA input noise voltage measurement circuit

Package Details: MLPQ 7X7



VER.	ESCN NUMBER	BY	DATE	APPROVAL INITIALS
7	REVISED PER ESCN 0421-06	GCR	8/7/06	
8	REVISED PER ESCN 37678	GCR	12/6/06	
9	REVISED PER ESCN 37834	GCR	1/8/07	
10	REVISED PER ESCN 38363	GCR	2/5/07	
11	REVISED PER ESCN 45228	GCR	2/2/09	
12	REVISED PER ESCN 45324	GCR	2/19/09	A. C.

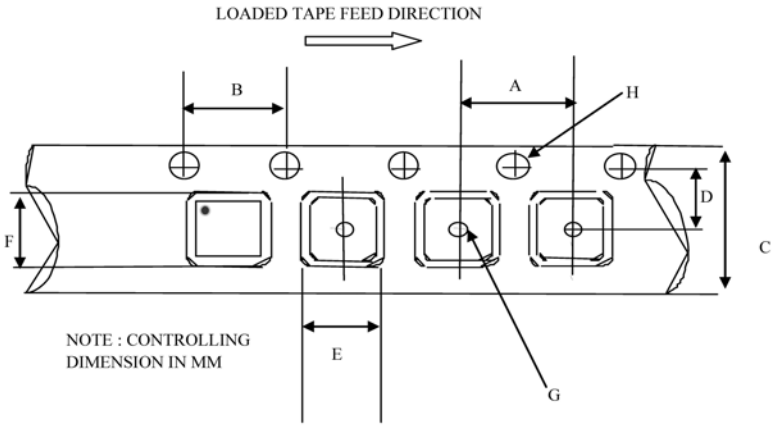
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE: IN INCHES
TOLERANCES ARE:
DECIMALS
.X = +/-
.XX = +/-
.XXX = +/-
.XXXX = +/-
.XXXXX = +/-
ANGLES
∠ = +/- .5°

QFN (MLPQ, MLF) PACKAGE OUTLINE

DRAWN BY	G. C. RAMOS 5/4/04	INTERNATIONAL RECTIFIER	
APPROVED BY	A. CALICDAN	EL SEGUNDO, CALIFORNIA	
SIGNATURE & DATE	A. Calicdan 2/19/09	CAD GENERATED	
DO NOT SCALE DRAWING	SCALE ENLGMT	SHEET 1/3	DRAWING NO. 01-3086 VER. 12

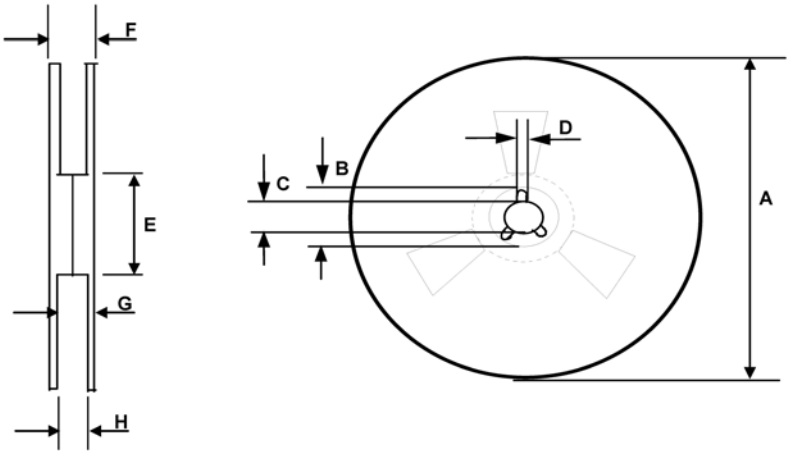
VKKD-4NJ1					
MILLIMETERS			INCHES		
MIN	NOM	MAX	MIN	NOM	MAX
0.80	0.90	1.00	.032	.035	.039
0.00	0.02	0.05	.000	.0008	.0019
0.20 REF			.008 REF		
0.18	0.25	0.30	.0071	.0098	.0118
5.40	5.55	5.65	.213	.219	.222
7.00 BSC			.276 BSC		
7.00 BSC			.276 BSC		
5.40	5.55	5.65	.213	.219	.222
0.30	0.40	0.50	.012	.016	.020
0.50 PITCH			.020 PITCH		
48			48		
12			12		
12			12		
0.15			.0059		
0.10			.0039		
0.10			.0039		
0.05			.0019		

Tape and Reel Details: MLPQ 7X7



CARRIER TAPE DIMENSION FOR 48MLPQ7X7

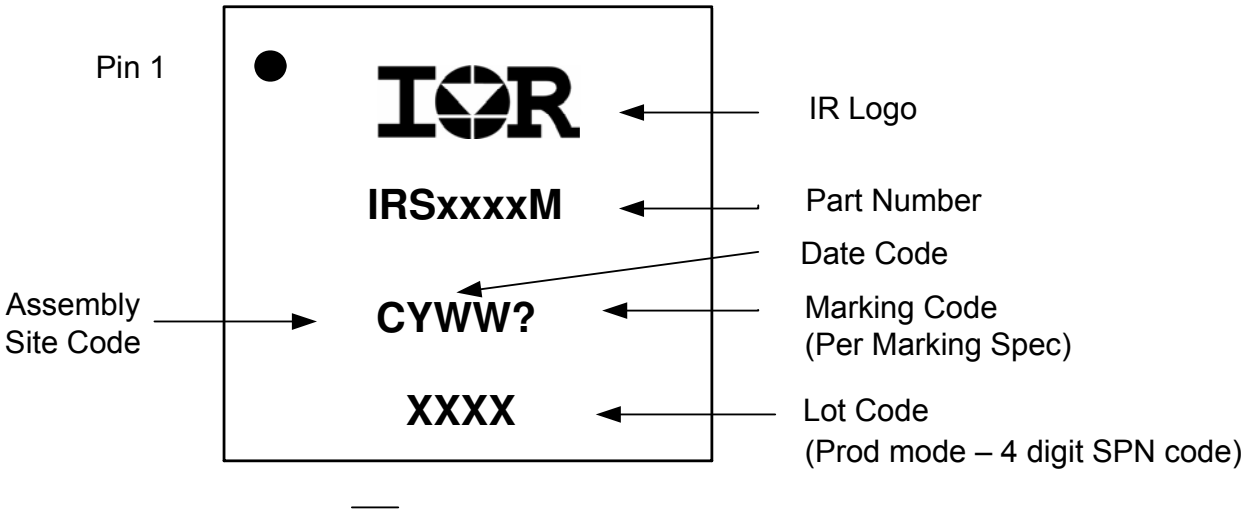
Code	Metric		Imperial	
	Min	Max	Min	Max
A	11.90	12.10	0.474	0.476
B	3.90	4.10	0.153	0.161
C	15.70	16.30	0.618	0.641
D	7.40	7.60	0.291	0.299
E	7.15	7.35	0.281	0.289
F	7.15	7.35	0.281	0.289
G	1.50	n/a	0.059	n/a
H	1.50	1.60	0.059	0.062



REEL DIMENSIONS FOR 48MLPQ7X7

Code	Metric		Imperial	
	Min	Max	Min	Max
A	329.60	330.25	12.976	13.001
B	20.95	21.45	0.824	0.844
C	12.80	13.20	0.503	0.519
D	1.95	2.45	0.767	0.096
E	98.00	102.00	3.858	4.015
F	n/a	22.4	n/a	0.881
G	18.5	21.1	0.728	0.83
H	16.4	18.4	0.645	0.724

Part Marking Information



Ordering Information

Base Part Number	Package Type	Standard Pack		Complete Part Number
		Form	Quantity	
IRS2053M	MLPQ 48 7x7	Tube / Bulk	52	IRS2053MPBF
		Tape and Reel	3000	IRS2053MTRPBF

For technical support, please contact IR's Technical Assistance Center
http://www.irf.com/technical-info/

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Tel: (310) 252-7105