High-Performance FM/AM/LW/SW/RDS Car Radio Receivers

Features：

- WorldwideFMbandsuppor:64–108MHz.
- WorldwideAMbandsuppor:520–1710kHz.
- LWbandsupport:144–288kHz (FSV4755
- only). SWbandsupport:2.3–30MHz
- (FSV4755 only).
- RDS/RBDS demodulator/decoder(FSV4755 only). Outstanding receiver performance:
- FM 111dBμV IP3 with –3dBμV sensitivity
- FM 70dB Audio SNR.
- Advanced AM/FM noise blankers.
- Dynamic AM/FM channel bandwidth control.
- Advanced AM/FM hi-cut control.
- AM lo-cut filter.
- Frequency synthesizer with fully-integrated PLL-VCO:
- Integrated clock oscillator.
- IntegratedFMactivesplitter:
- Addresses companion AF scanning and TMC reception.
- Analog FM MPX output(FSV4755
- only). Digital(I2S) audio
- output(FSV4755 only). Advanced FM
- stereo-mono blend.
- Programmable AM/FM soft mute.
- Full suite of signal metrics: RSSI,USN, SNR, multipath interference, frequency
- offset,adjacent channel RSSI.
- Digital Low-IF architecture:
- Eliminates expensive 10.7 MHz IF ceramic filters. On-chip AM/FM AGC with integrated resistor
- and capacitor banks.
- 1.8V to 5.0V power supplies.
- QFN 32-pin, 5 x 5 mm.

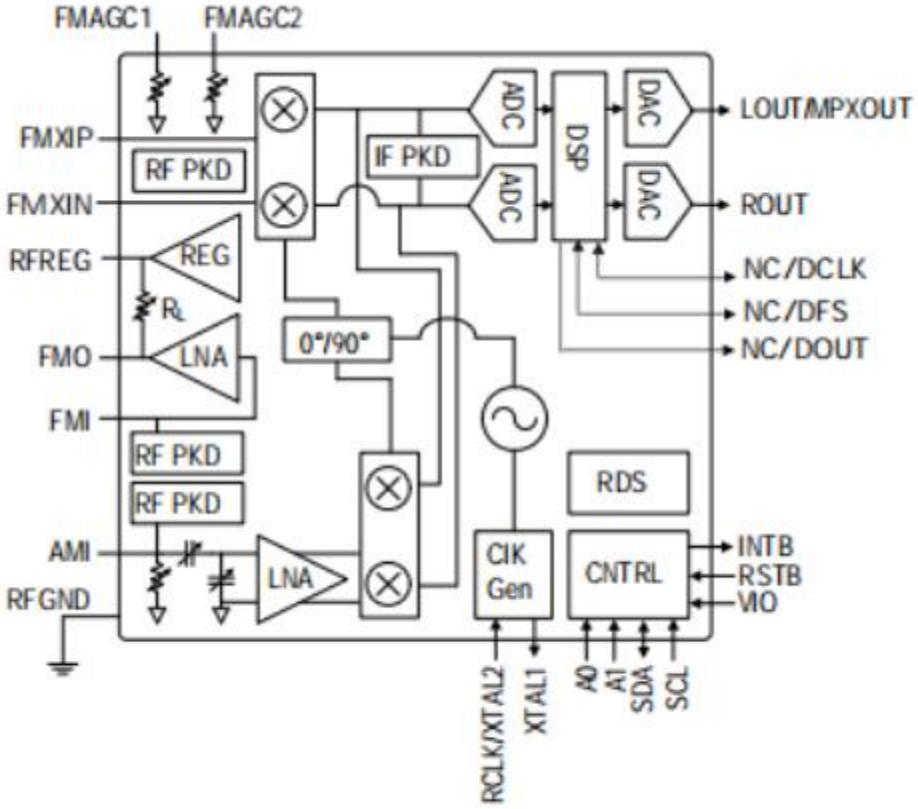
Applications：

- OEM automotive infotainment systems.
- OEM automotive PND dockingsystems.
- After-market car radio systems.

Description：

The FSV4754/55 AM/FM receiver employs digital low-IF architecture to bring outstanding receiver performance to the automotive infotainment industry.

Block diagram:



Electrical specifications

Recommended operation conditions:

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Analog supply voltage	V_A		4.5	5	5.5	V
Digital supply voltage	V_D		2.7	3.3	3.6	V
Interface supply voltage	V_{IO}		1.7	3.3	3.6	V
Analog power supply powerup rise time	V_A RISE		10	—	—	μs
Digital power supply powerup rise time	V_D RISE		10	—	—	μs
Interface power supply powerup rise time	V_{IO} RISE		10	—	—	μs

Note: All minimum and maximum specifications are guaranteed and apply across the recommended operating conditions. Typical values apply at V_D = 3.3 V, V_{IO}= 3.3 V, V_A = 5 V, and 25 °C unless otherwise stated. Parameters are tested in production unless otherwise stated.

DC characteristics:

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V.

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
FM Mode						
Total supply power			671	850	1075	mW
V_A supply current	I_{VA}		121	130	141	mA
V_D supply current	I_{VD}		47	60	82	mA
V_A Supply power down current	I_{VA}		20	90	170	μA
V_D Supply power down current	I_{VD}		5	25	50	μA
AM Mode						
Total supply power			707	900	1100	mW
V_A supply current	I_{VA}		129	140	150	mA
V_D supply current	I_{VD}		47	60	85	mA
V_A Supply power down current	I_{VA}		20	90	170	μA
V_D Supply power down current	I_{VD}		5	25	50	μA

DC characteristics (continued):

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V.

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Interface supplies						
V_{IO} supply current	I_{VIO}		0.1	0.5	1	mA
V_{IO} supply power down current	I_{PD}		150	250	420	µA
Inputs Pins SCL, SDA, RSTB, A0, A1						
High level input voltage	V_{IH}		0.7 x V_{IO}	—	—	V
Low level input voltage	V_{IL}		—	—	0.3xV_{IO}	V
High level input current	I_{IH}	V_{IN} = V_{I0} = 3.6 V	–10	—	10	µA
Low level input current	I_{IL}	V_{IN} = 0 V, V_{I0} = 3.6 V	–10	—	10	µA
Output Pins INTB						
High level output voltage	V_{OH}	Output is common-drain output with internal 10 kΩ pull-up to V_{IO}	0.8 x V_{IO}	—	—	V
Low level output voltage	V_{OL}	I_{OUT} = –500 µA	—	—	0.2xV_{IO}	V
Output Pins SDA						
High level output voltage	V_{OH}	Output is common-drain output with external 4.7 kΩ pull-up to V_{IO}	0.8 x V_{IO}	—	—	V
Low level output Voltage	V_{OL}	I_{OUT} = –500 µA	—	—	0.2xV_{IO}	V

FM receiver characteristics:

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, FM modulation (L = R), F_{MOD} = 1 kHz, F_{DEV}= 22.5 kHz, de-emphasis = 75 µs, RF level = 60 dBµV, F_{RF} = 98 MHz.

Parameter	Test Condition	Min	Typ	Max	Unit
Input frequency		64	—	108	MHz
Frequency step resolution		10	—	200	kHz
Powerup time				100	ms
Tune time		—	3	—	ms
AF check time	Includes mute and unmute times with RSSI, SNR, frequency offset, and multipath metrics qualified	—	8	—	ms
Seek time/channel	At Lout and Rout pins	—	20	—	ms
Max frequency deviation	Audio THD <1%, over-deviation handling enabled	—	150	—	kHz
RF AGC range	With FMAGC1 and FMAGC2 resistor banks	—	40	—	dB
AGC gain resolution		—	—	2	dB
RF AGC threshold accuracy		—	2	—	dB
FM LNA:					
Single receiver mode					
FMI input resistance		—	50	—	Ω
FMI input capacitance		—	2	—	pF
FMI return loss	64 MHz < F < 108 MHz	—	15	—	dB
FMI input referred noise	—	—	0.73	—	$nV/\sqrt{Hz}$
FMI LNA IP3	Blockers at 400/800 kHz offset, Max Gain	—	128	—	dBµV
FMO output resistance	Nominal FMI to FMO gain = 8 dB, Source load = 50 Ω	—	125	—	Ω
FMO output capacitance		—	2	—	pF

Notes:

1. Measured at T_A= 25 °C.
2. Noise integrated from 30 Hz to 120 kHz .
3. No A-weighting. Noise integrated from 30 Hz to 15 kHz .

FM receiver characteristics (continued):

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, FM modulation (L = R), F_{MOD} = 1 kHz, F_{DEV}= 22 .5 kHz, de-emphasis = 75 µs, RF level = 60 dBµV, F_{RF} = 98 MHz .

Parameter	Test Condition	Min	Typ	Max	Unit
Dual receiver mode:					
FMI input resistance		—	100	—	Ω
FMI input capacitance		—	1.5	—	pF
FMI return loss	64 MHz < F < 108 MHz	—	15	—	dB
FMI input referred noise		—	1.20	—	nV/$\sqrt{Hz}$
FMI LNA IP3	Blockers at 400/800 kHz offset, Max Gain	—	126	—	dBµV
FMO output resistance	Nominal FMI to FMO gain = 8dB, Source load = 50 Ω	—	250	—	Ω
FMO output capacitance		—	2	—	pF
Audio outputs:					
Audio frequency response low	±3 dB	—	—	30	Hz
Audio frequency response high	±3 dB	15	—	—	kHz
Output load resistance	At LOUT and ROUT pins	10 k	—	—	Ω
Output load capacitance	At LOUT and ROUT pins	—	—	50	pF
Output voltage	Deviation = 22.5 kHz	98	112	124	mVRMS
Power supply rejection ratio	100 Hz ripple on power supply lines. Ripple voltage = 100 mV_{PP}	—	45	—	dB

Notes:

1. Measured at T_A= 25 °C.
2. Noise integrated from 30 Hz to 120 kHz .
3. No A-weighting. Noise integrated from 30 Hz to 15 kHz .

FM receiver characteristics (continued):

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, FM modulation (L = R), F_{MOD} = 1 kHz, F_{DEV}= 22.5 kHz, de-emphasis = 75 µs, RF level = 60 dBµV, F_{RF} = 98 MHz .

Parameter	Test Condition	Min	Typ	Max	Unit
FM MPX output:					
Output voltage	F_{RF} = 83 MHz, RF level = 65 dBµV, F_{DEV} = 3 kHz, F_{MOD} = 76 kHz	14	16	—	mVRMS
Output load resistance		—	10	—	kΩ
Output load capacitance		—	50	—	pF
PSRR	100 Hz ripple on power supply lines. Ripple voltage = 100 mV_{PP}	—	45	—	dB
Bandwidth		110	—	—	kHz
FM MPX specifications :					
(S+N)/N	F_{RF} = 83 MHz, RF level = 65 dBµV, F_{DEV} = 3 kHz, F_{MOD} = 76 kHz	25	30	—	dB
Sensitivity	F_{RF} = 83 MHz, F_{DEV} = 3 kHz, F_{MOD} = 76 kHz,SINAD = 5 dB	—	19	25	dBµV
FM receiver specifications :					
IP3	Blockers at 400/800 kHz offset AGC disabled (max RF gain)	107	111	—	dBµV
Sensitivity	Audio SINAD = 26 dB AGC disabled (max RF gain	—	–3	–0.5	dBµV
Image rejection	Deviation = 22.5 kHz	—	65	—	dB
Adjacent channel rejection	Audio SINAD = 26 dB Desired = 40dBµV, F_{MOD} = 1 kHz, F_{DEV} = 22.5 kHz Undesired at ±100 kHz offset, F_{MOD} = 400 Hz, F_{DEV} = 22.5 kHz	59	62	—	dB

Notes:

1. Measured at T_A= 25 °C.
2. Noise integrated from 30 Hz to 120 kHz .
3. No A-weighting. Noise integrated from 30 Hz to 15 kHz .

FM receiver characteristics (continued):

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, FM modulation (L = R), F_{MOD} = 1 kHz, F_{DEV}= 22.5 kHz, de-emphasis = 75 µs, RF level = 60 dBµV, F_{RF} = 98 MHz.

Parameter	Test Condition	Min	Typ	Max	Unit
Alternate channel rejec-tion	Audio SINAD = 26 dB Desired = 40 dBµV, F_{MOD} = 1 kHz, F_{DEV} = 22.5 kHz Undesired at ±200 kHz offset, F_{MOD} = 400 Hz, F_{DEV} = 22.5 kHz	65	72	—	dB
THD	F_{DEV} = 75 kHz	—	0.05	0.1	%
Mono (S+N)/N		65	70	—	dB
Stereo (S+N)/N	Stereo modulation (L = 1, R = 0), deviation = 67.5 kHz, pilot deviation = 6.75 kHz	64	67	—	dB
AM suppression	AM: m = 0.3/Fmod = 1 kHz, RF level = 60 dBµV	55	60	—	dB
De-emphasis time constant	—	70	75	80	µs
	—	45	50	54	µs
L/R Imbalance	Deviation = 75 kHz	–1	—	1	dB
Stereo separation	Stereo modulation (L = 1, R = 0), deviation = 67.5 kHz, pilot deviation = 6.75 kHz	40	45	—	dB
Stereo distortion	Stereo modulation (L = 1, R = 0), deviation = 67.5 kHz, pilot deviation = 6.75 kHz	—	0.1	0.2	%
Pilot signal rejection	Stereo modulation (L = 1, R = 1), deviation = 67.5 kHz, pilot deviation = 6.75 kHz	60	65	—	—
RDS sensitivity	Δf = 2 kHz, RDS BLER < 5%	—	14	—	dBµV
RDS synchronization time	Δf = 2 kHz RF input = 60 dBµV	—	74	—	ms
RDS PI lock time	Δf = 2 kHz RF input = 60 dBµV	—	90	—	ms

Notes:

1. Measured at T_A= 25 °C.
2. Noise integrated from 30 Hz to 120 kHz .
3. No A-weighting. Noise integrated from 30 Hz to 15 kHz .

AM receiver characteristics:

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, AM modulation = 30%, F_{MOD} = 1 kHz, RF level =74 dBµV, F_{RF} = 1 MHz .

Parameter	Test Condition	Min	Typ	Max	Unit
Input frequency		520	—	1710	kHz
Frequency step resolution		1	—	10	kHz
Powerup time				100	ms
Tune time		—	15	—	ms
Seek time/channel	At Lout and Rout pins	—	55	—	ms
Maximum RF input voltage	Mod = 30%, Fmod = 1 kHz, SINAD = 57 dB	—	—	145	dBµV
Image rejection		68	72	—	dB
Adjacent channel rejection	SINAD = 20 dB desired = 40 dBµV, F_{MOD} = 1 kHz, MOD = 30% undesired at ±9 kHz offset, F_{MOD} = 400 Hz, MOD = 30%	57	62	—	dB
Alternate channel rejection	SINAD = 20 dB desired = 40dBµV, F_{MOD} = 1 kHz, MOD = 30% undesired at ±18 kHz offset, F_{MOD} = 400 Hz, MOD = 30%	62	65	—	dB
IP3	blockers at 40/80 kHz, AGC disabled (max gain)	140	143	—	dBµV
IP2	Desired = 700 kHz, undesired = 1000 kHz, 1700 kHz AGC disabled (max gain)	174	180	—	dBµV
RF AGC range		—	50	—	dB
AGC step resolution			2		dB
RFAGC threshold accuracy		—	2	—	dB
Sensitivity	SINAD = 20 dB, AGC disabled (max RF gain)	—	28	32	dBµV
Audio SNR		57	60	—	dB
THD		—	0.05	0.1	%
THD at Strong signal level	RF level = 120 dBµV	—	0.05	0.1	%

Notes:

1. Measured at T_A= 25 °C.
2. No A-weighting. Noise integrated from 30 Hz to 15 kHz.
3. Specifications referred application circuit with 15 pF/50pF antenna dummy.

AM receiver characteristics (continued):

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, AM modulation = 30%, F_{MOD} = 1 kHz, RF level = 74 dBµV, F_{RF} = 1 MHz .

Parameter	Test Condition	Min	Typ	Max	Unit
SNR atStrong signal level	Mod = 30%, RF level = 120 dBµV	67	72	—	dB
Audio outputs:					
Audio output resistance load		10k	—	—	Ω
Audio output capacitance load	Single ended	—	—	50	pF
Audio output voltage		92	105	118	mVRMS
PSRR at audio output pins	Ripple test should be for 100 Hz ripple voltage = 100 mV_{PP}	—	45	—	dB

Notes:

1. Measured at T_A= 25 °C.
2. No A-weighting. Noise integrated from 30 Hz to 15 kHz.
3. Specifications referred application circuit with 15 pF/50pF antenna dummy.

LW receiver characteristics :

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V, $_{MOD}$ = 1 kHz, MOD = 30%, F_{RF} = 198 kHz, RF level = 74 dBμV .

Parameter	Test Condition	Min	Typ	Max	Unit
Input frequency		144	—	288	kHz
Frequency step resolution		1	—	10	kHz
Sensitivity	Audio SINAD = 20 dB	—	31	34	dBuV
Audio SNR		56	58	—	dB
Adjacent channel rejection	Audio SINAD = 20 dB desired = 40 dBμV, F_{MOD} = 1 kHz, MOD = 30% undesired at ±9 kHz F_{MOD} = 400 Hz, MOD = 30%	58	60	—	dB
RF AGC range		—	45	—	dB
AGC step resolution		—	2	—	dB
RFAGC threshold accuracy		—	2	—	dB

Notes:

1. Measured at T_A= 25 °C.
2. No A-weighting. Noise integrated from 30 Hz to 15 kHz.
3. Specifications referred application circuit with 15 pF/50pF antenna dummy.

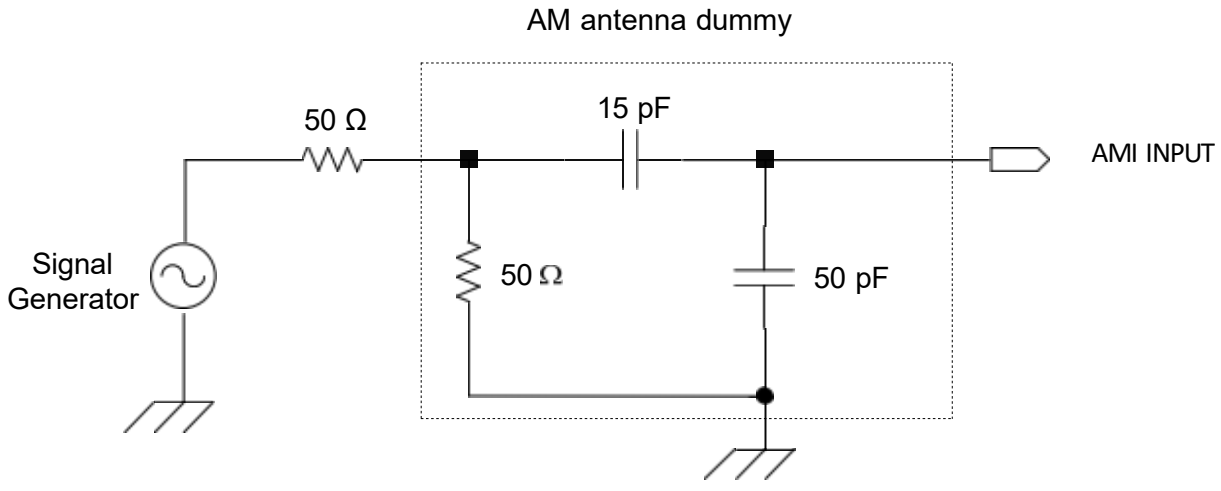
SW receiver characteristics :

T_A= –40 to 85 °C, V_A= 4.5 to 5.5 V, V_D= 2.7 to 3.6 V, V_{IO} = 1.7 to 3.6 V,
F_{MOD}= 1 kHz,MOD = 30%, F_{RF} = 6000 kHz, RF level = 74 dBμV .

Parameter	Test Condition	Min	Typ	Max	Unit
Input frequency		2.3	—	30	MHz
Frequency step resolution		1	—	10	kHz
Sensitivity	Audio SINAD = 20 dB	—	28	32	dBμV
Audio SNR		58	60	—	dB
Adjacent channel rejection	Audio SINAD = 20 dB desired = 40 dBμV, F_{MOD} = 1 kHz, MOD = 30% undesired at ±5 kHz F_{MOD} = 400 Hz, MOD = 30%	58	60	—	dB
RF AGC range		—	50	—	dB
AGC step resolution		—	2	—	dB
RF AGC threshold accuracy		—	2	—	dB
IF AGC threshold accuracy		—	2	—	dB

Notes:

1. Measured at T_A= 25 °C.
2. No A-weighting. Noise integrated from 30 Hz to 15 kHz.
3. Specifications referred application circuit with 15 pF/50pF antenna dummy.



AM test circuit

Thermal conditions:

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Ambient temperature	T_A		–40	25	85	°C
Junction temperature	T_J		—	—	115	°C
Delta from junction to ambient	θ_{JA}		—	27	—	°C/W

Note: The θ_{JA} is layout-dependent, and, therefore, PCB layout must provide adequate heat-sink capability. The θ_{JA} is specified assuming adequate ground plane.

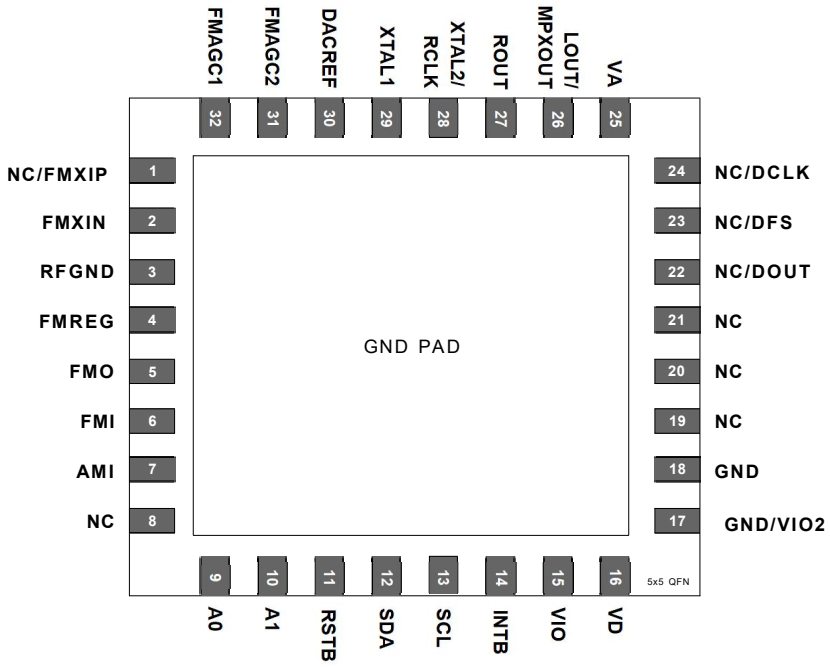
Absolute maximum ratings:

Parameter	Symbol	Min	Max	Unit
Analog supply voltage	V_A	–0.5	5.9	V
Digital supply voltage	V_D	–0.5	3.9	V
I/O supply voltage	V_{IO}	–0.5	3.9	V
I/O input current	I_{IN}	–10	10	mA
I/O input voltage	V_{IN}	–0.3	V_{I01} + 0.3	V
Operating temperature	T_{OP}	–40	95	°C
Junction temperature	T_j	—	125	°C
Storage temperature	T_{STG}	–55	150	°C
AM RF input level	V_{RFIN}	–1	V_A + 1	V
AM RF input current	I_{RFIN}	–100	100	mA
FM RF input level	V_{RFIN}	–1	1	V
FM RF input current	I_{RFIN}	–100	100	mA
HBM ESD	V_{HBM}	–2	2	kV
MM ESD	V_{MM}	–200	200	V
CDM ESD	V_{CDM}	–500	500	V
CDM ESD	V_{CDM}	–750	750	V

Notes:

1. For input pins SCL, SDA, RSTB, A0, A1.
2. At RF input pin AMI.
3. At RF input pins FMXI, FMI, FMAGC1, and FMAGC2.

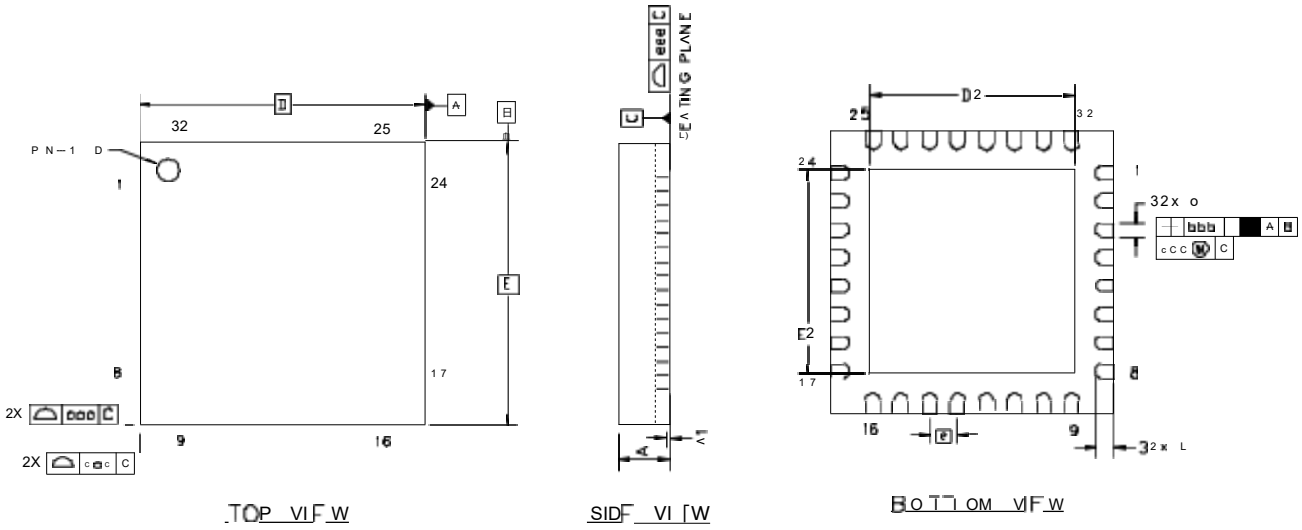
Pin descriptions:



Pin Number	Name	I/O	Description
1	NC/FMXIP	I	No connect/Balanced input to FM mixer (positive)(FSV4755B only)
2	FMXIN	I	Single ended input to FM mixer
3	RFGND	I	RF Ground
4	FMREG	O	FM LNA regulator
5	FMO	O	FM LNA output
6	FMI	I	FM LNA input: Antenna trace should be connected here.
7	AMI	I	AM Single ended input
8	NC		No connect. Leave floating
9	A0	I	I2C Address 0
10	A1	I/O	I2C Address 1
11	RSTB	I	Global Chip Reset
12	SDA	I/O	I2C Data input/output
13	SCL	I	I2C clock
14	INTB	O	Interrupt, active low

Pin Number	Name	I/O	Description
15	VIO	S	Host I/O Supply Voltage
16	VD	S	Digital Voltage Supply
17	GND/VIO2	I	Ground/Digital audio supply voltage(I2S output only)
18	GND	I	Ground.
19	NC		No connect. Leave floating
20	NC		No connect. Leave floating
21	NC		No connect. Leave floating
22	NC/DOUT	O	No connect/Digital audio data output(I2S output only)
23	NC/DFS	I	No connect/Digital audio frame sync input(I2S output only)
24	NC/DCLK	I	No connect/Digital audio data input(I2S output only)
25	VA	S	Analog voltage supply
26	LOUT/MPXOUT	O	Left audio line out/ FM MPX output
27	ROUT	O	Right audio out
28	XTAL2/RCLK	I	Crystal oscillator/reference clock input
29	XTAL1	O	Crystal oscillator output
30	DACREF	I	Voltage reference for analog outputs
31	FMAGC2	I	FM automatic gain control 2
32	FMAGC1	I	FM automatic gain control 1
PDL	GND PAD	I	Ground. Reference ground

Package outline:



32-Pin quad flat No-lead (QFN)

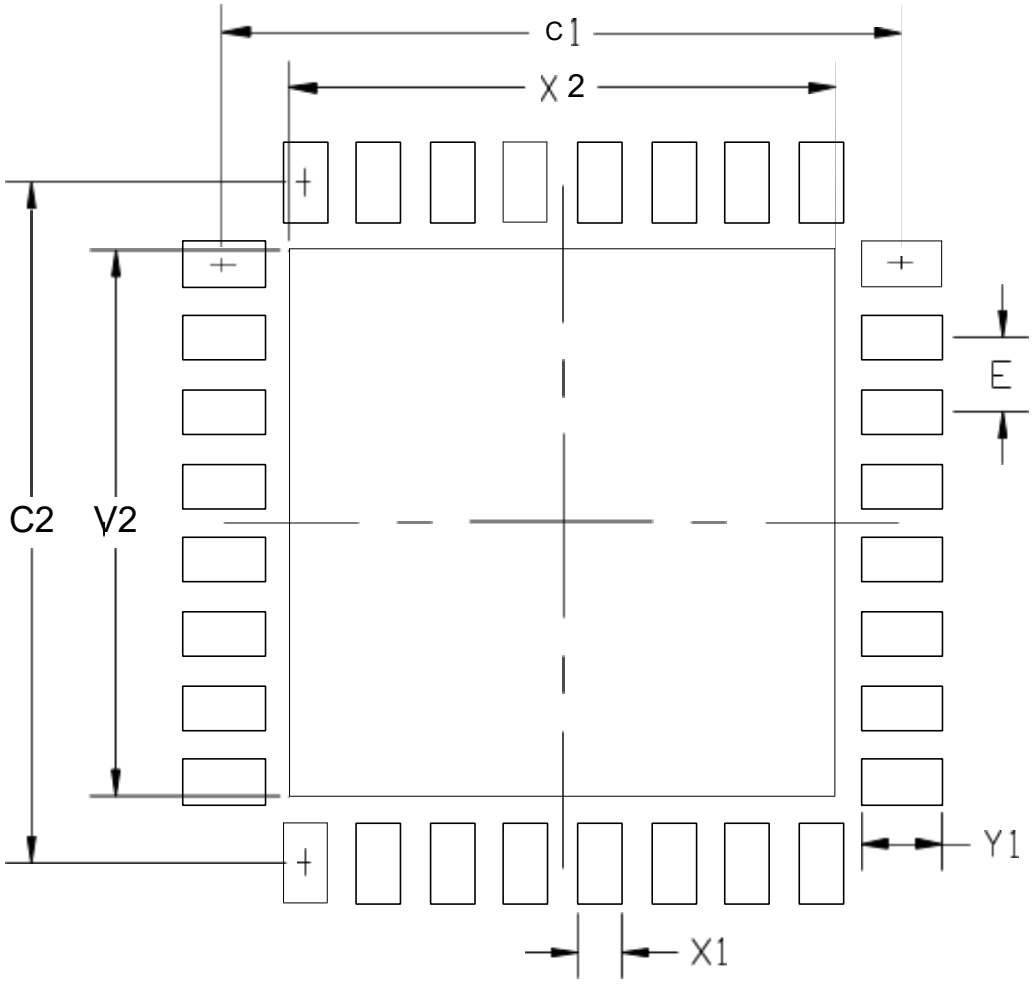
Package dimensions

Dimensions	Min	Nom	Max
A	0.80	0.85	0.90
A1	0.00	0.02	0.05
b	0.18	0.25	0.30
D		5.00 BSC.	
D2	3.45	3.60	3.75
e		0.50 BSC.	
E		5.00 BSC.	
E2	3.50	3.60	3.70
L	0.35	0.40	0.45
aaa	—	—	0.15
bbb	—	—	0.10
ddd	—	—	0.05
eee	—	—	0.08

Notes:

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing per ANSI Y14.5M-1994.
3. This drawing conforms to the JEDEC Solid State Outline MO-220, variation VHHD except for custom features D2, E2, L, and L1 which are toleranced per supplier designation.
4. Recommended card reflow profile is per the JEDEC/IPC J-STD-020 specification for Small Body Components.

PCB land pattern:



PCB land pattern

Dimensions	Min	Max
C1	4.60	
C2	4.60	
E	0.50	
X1	0.20	0.30
X2	3.60	3.70
Y1	0.45	0.55
Y2	3.60	3.70

Notes:

General

1. All dimensions shown are in millimeters (mm) unless otherwise noted.
2. Dimensioning and Tolerancing is per the ANSI Y14.5M-1994 specification.
3. This Land Pattern Design is based on the IPC-7351 guidelines.

Solder Mask Design

4. All metal pads are to be non-solder mask defined (NSMD). Clearance between the solder mask and the metal pad is to be 60 μm minimum, all the way around the pad.

Stencil Design

5. A stainless steel, laser-cut and electro-polished stencil with trapezoidal walls should be used to assure goodsolder paste release.
6. The stencil thickness should be 0.125 mm (5 mils).
7. The ratio of stencil aperture to land pad size should be 1:1 for all perimeter pins.
8. A 3x3 array of 1.0mm openings on a 1.25mm pitch should be used for the center pad to assure the proper paste volume.

PCB land pattern dimensions