Fast Ultra High-PSRR, Low-Noise, 300mA CMOS Linear Regulator

General Description

The EMP8734 features ultra-high power supply rejection ratio, low output voltage noise, low dropout voltage, low quiescent current and fast transient response. It guarantees delivery of 300mA output current and supports preset output voltages ranging from 0.8V to 4.5V with 0.05V increment.

Based on its low quiescent current consumption and its less than 1μA shutdown mode of logical operation, the EMP8734 is ideal for battery-powered applications. The high power supply rejection ratio of the EMP8734 holds well for low input voltages typically encountered in battery-operated systems. The regulator is stable with small ceramic capacitive loads (1μF typical). The EMP8734 is Available in miniature SOT-23-5 SOT-353(SC-70-5), SOT-343 and TDFN-6 packages.

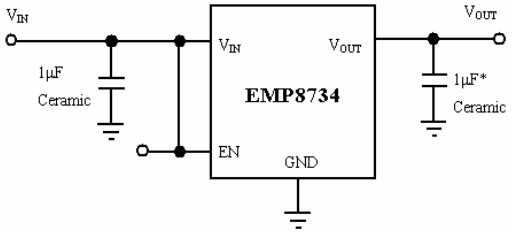
Features

- 300mA guaranteed output current
- 62dB typical PSRR at 1kHz
- 110μV RMS output voltage noise (10Hz to 100kHz)
- 290mV typical dropout at 300mA
- 57μA typical quiescent current
- Less than 1μA typical shutdown mode
- Fast line and load transient response
- 2.2V to 5.5V input range
- Auto-discharge during chip disable
- 80μs typical turn-on time
- Stable with small ceramic output capacitors
- Over temperature and over current protection
- ±2% output voltage tolerance

Applications

- Wireless handsets
- PCMCIA cards
- DSP core power
- Hand-held instruments
- Battery-powered systems
- Portable information appliances

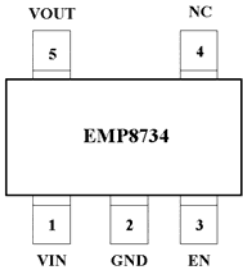
Typical Application



*Use 2.2μF for V_{OUT} < 1.2V

CONNECTION DIAGRAM

SOT-23-5(TOP View)



ORDER INFORMATION

EMP8734-XXVF05GRR

XX Output voltage

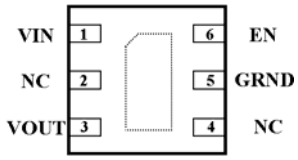
VF05 SOT-23-5 Package

GRR RoHS & Halogen free

Rating: -40 to 85°C

Package in Tape & Reel

TDFN-6(TOP View)



EMP8734-XXFE06NRR

XX Output voltage

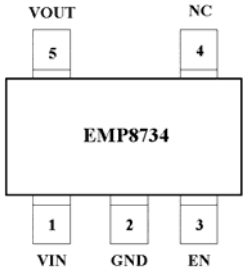
FE06 TDFN-6 Package

NRR RoHS & Halogen free

Rating: -40 to 85°C

Package in Tape & Reel

SOT-353 (SC-70-5) (TOP View)



EMP8734-XXVI05NRR

XX Output voltage

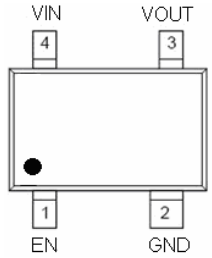
VI05 SOT-353 Package

NRR RoHS & Halogen free

Rating: -40 to 85°C

Package in Tape & Reel

SOT-343 (SC-82-4) (TOP View)



EMP8734-XXVJ04NRR

XX Output voltage

VJ04 SOT-343 Package

NRR RoHS & Halogen free

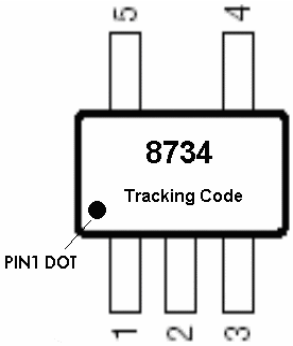
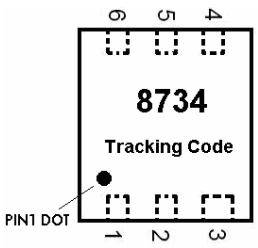
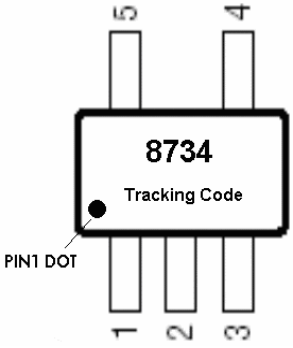
Rating: -40 to 85°C

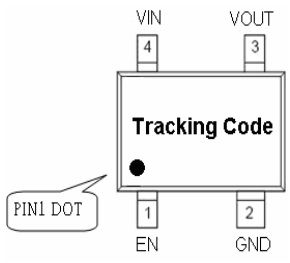
Package in Tape & Reel

Pin Functions

Name	SOT-23-5	TDFN-6	SOT-353	Function
VIN	1	1	1	**Supply Voltage Input**. Require a minimum input capacitor of close to 1μF to ensure stability and sufficient decoupling from the ground pin.
GND	2	5	2	**Ground Pin**.
EN	3	6	3	**Enable Input.** Enable the regulator by pulling the EN pin High. To keep the regulator on during normal operation, connect the EN pin to VIN. The EN pin must not exceed VIN under all operating conditions.
NC	4	2/4	4	**No Connection**
VOUT	5	3	5	**Output Voltage Feedback**.

Order, Mark & Packing Information

Marking	Vout	Product ID	Packing
	1.2	EMP8734-12VF05GRR	3K units Tape & Reel
	1.5	EMP8734-15VF05GRR	3K units Tape & Reel
	1.8	EMP8734-18VF05GRR	3K units Tape & Reel
	2.5	EMP8734-25VF05GRR	3K units Tape & Reel
	2.8	EMP8734-28VF05GRR	3K units Tape & Reel
	3.0	EMP8734-30VF05GRR	3K units Tape & Reel
	3.3	EMP8734-33VF05GRR	3K units Tape & Reel
	2.5	EMP8734-25FE06NRR	5K units Tape & Reel
	1.2	EMP8734-12VI05NRR	3K units Tape & Reel
	1.3	EMP8734-13VI05NRR	3K units Tape & Reel
	1.8	EMP8734-18VI05NRR	3K units Tape & Reel
	2.5	EMP8734-25VI05NRR	3K units Tape & Reel
	3.3	EMP8734-33VI05NRR	3K units Tape & Reel

Marking	Vout	Product ID	Packing
	1.2	EMP8734-12VJ04NRR	3K units Tape & Reel
	1.8	EMP8734-18VJ04NRR	
	2.8	EMP8734-28VJ04NRR	
	3.3	EMP8734-33VJ04NRR	

Absolute Maximum Ratings (Notes 1, 2)

VIN, VOUT, VEN	-0.3V to 6.5V
Storage Temperature Range	-65°C to160°C
Junction Temperature (T_J)	150°C
Lead Temperature (10 sec.)	240°C
ESD Rating	
Human Body Model	2kV
MM	200V

Thermal Resistance (θ_{JA})	
SOT-23-5	250°C/W
SOT-343/SOT-353	(Note 6)
TDFN-6	(Note 6)

Operating Ratings (Note 1, 2)

Temperature Range	-40°C to 85°C
Supply Voltage	2.2V to 5.5V

Electrical Characteristics

Unless otherwise specified, all limits guaranteed for $V_{IN} = V_{OUT}$ +1V (Note 3), $V_{EN}=V_{IN}$, $C_{IN} = C_{OUT}$ = 2.2µF, T_A = 25°C.
Boldface limits apply for the operating temperature extremes: -40°C and 85°C.

Symbol	Parameter	Conditions	Min	Typ	Max	Units
V_{IN}	Input Voltage		**2.2**		**5.5**	V
V_{OUT}	Output Voltage		**0.8**		**4.5**	V
ΔV_{OTL}	Output Voltage Tolerance	1mA ≤ I_{OUT} ≤ 300mA $V_{OUT\ (NOM)}$ +1V ≤ VIN ≤ 5.5V (Note 3)	-2		+2	% of $V_{OUT\ (NOM)}$
			-3		**+3**	
I_{OUT}	Maximum Output Current	Average DC Current Rating	**300**			mA
I_{LIMIT}	Output Current Limit		**300**	450		mA
I_Q	Supply Current	I_{OUT} = 0mA		57		µA
		I_{OUT} = 300mA		130		
	Shutdown Supply Current	V_{OUT} = 0V, EN = GND		0.001	1	
V_{DO}	Dropout Voltage (Note4)	I_{OUT} = 100mA		90		mV
		I_{OUT} = 300mA		290		
ΔV_{OUT}	Line Regulation	I_{OUT} = 1mA, (V_{OUT} + 1V) ≤ V_{IN} ≤ 5.5V (Note 3)	-0.1	0.01	0.1	%/V
	Load Regulation	1mA ≤ I_{OUT} ≤ 300mA		0.0008		%/mA
e_n	Output Voltage Noise	V_{OUT}=2.5V, I_{OUT} = 10mA, 10Hz ≤ f ≤ 100kHz		110		μV_{RMS}
T_{SD}	Thermal Shutdown Temperature			165		℃
	Thermal Shutdown Hysteresis			35		
V_{EN}	EN Input Threshold	V_{IH}, (V_{OUT} + 1V) ≤ V_{IN} ≤ 5.5V (Note 3)	**1.2**			V
		V_{IL}, (V_{OUT} + 1V) ≤ V_{IN} ≤ 5.5V (Note 3)			**0.4**	
I_{EN}	EN Input Bias Current	EN = GND or VIN		0.1	100	nA
T_{ON}	Turn-On Time	V_{OUT} at 95% of Final Value		80		µs
T_{OFF}	Turn-Off Time	I_{OUT}=0mA (Note 5)		2.4		ms

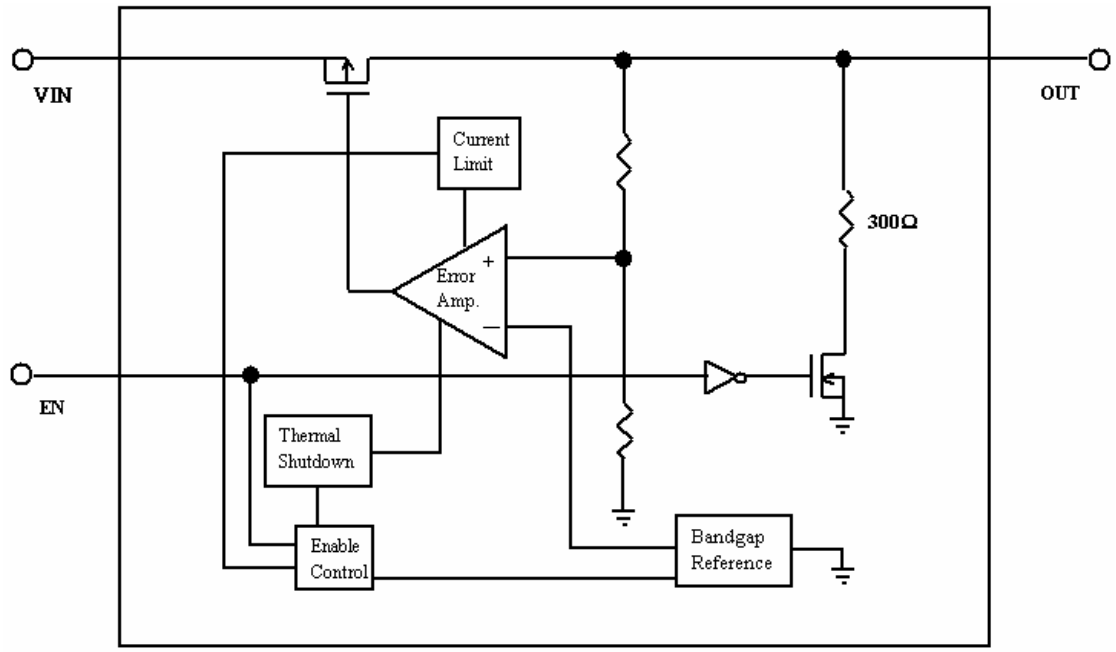
Note 1: Absolute Maximum ratings indicate limits beyond which damage may occur. Electrical specifications do not apply when operating the device outside of its rated operating conditions.

Note 2: All voltages are with respect to the potential at the ground pin.
Note 3: Condition does not apply to input voltages below 2.2V since this is the minimum input operating voltage.
Note 4: Dropout voltage is measured by reducing V_{IN} until V_{OUT} drops 100mV from its nominal value at V_{IN} -V_{OUT} = 1V. Dropout voltage does not apply to the regulator versions with V_{OUT} less than 2.2V.
Note 5: Turn-off time is time measured between the enable input just decreasing below V_{IL} and the output voltage just decreasing to 10% of its nominal value.
Note 6: Maximum Power dissipation for the device is calculated using the following equations:

$$P_D = \frac{T_{J(MAX)} - T_A}{\theta_{JA}}$$

where $T_{J(MAX)}$ is the maximum junction temperature, T_A is the ambient temperature, and θ_{JA} is the junction-to-ambient thermal resistance. E.g. for the SOT-23-5 package θ_{JA} = 250°C/W, $T_{J(MAX)}$ = 150°C and using T_A = 25°C, the maximum power dissipation is found to be 500mW. The derating factor (-1/θ_{JA}) = -4mW/°C, thus below 25°C the power dissipation figure can be increased by 4mW per degree, and similarity decreased by this factor for temperatures above 25°C. The value of the θ_{JA} for the TDFN-6 package is specifically dependent on the PCB trace area, trace material, and the number of layers and thermal vias.

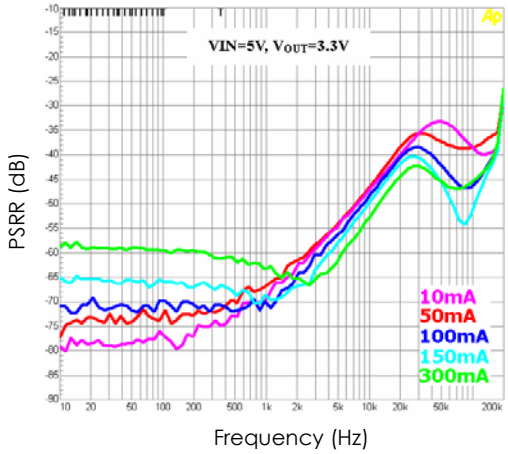
Functional Block Diagram



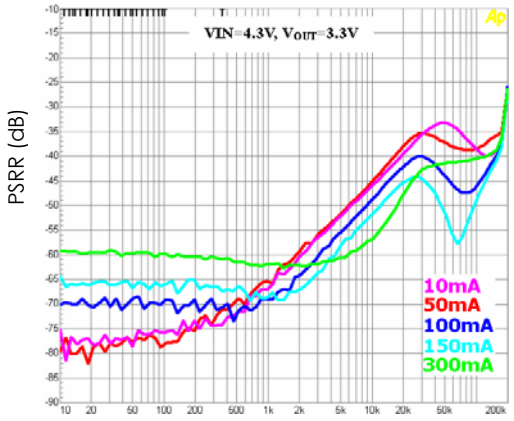
Typical Performance Characteristics

Unless otherwise specified, VIN = $V_{OUT\ (NOM)}$ + 1V, V_{EN}=V_{IN}, C_{IN} = C_{OUT} = 2.2μF, T_A = 25°C.

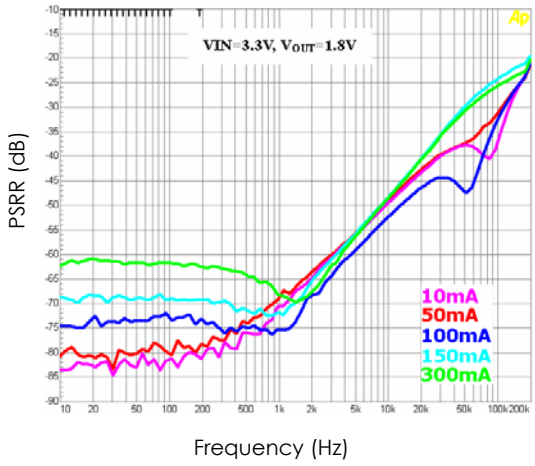
PSRR vs. Frequency



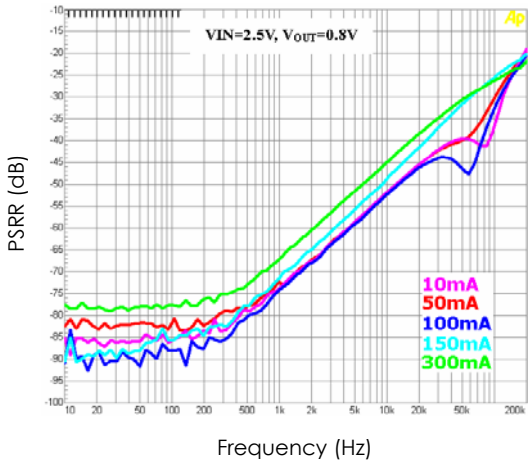
PSRR vs. Frequency



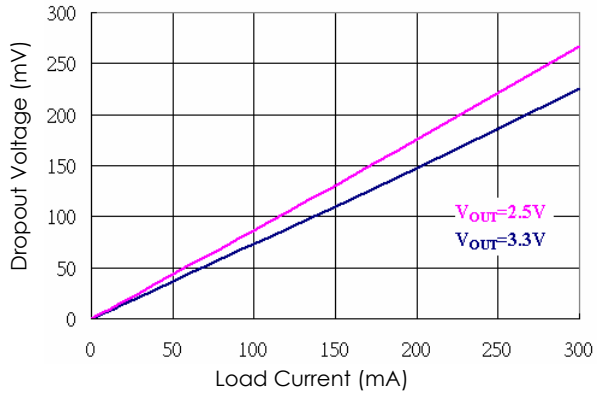
PSRR vs. Frequency



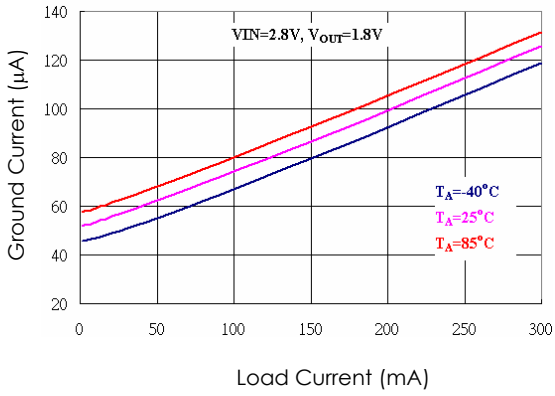
PSRR vs. Frequency



Dropout Voltage vs. Load Current



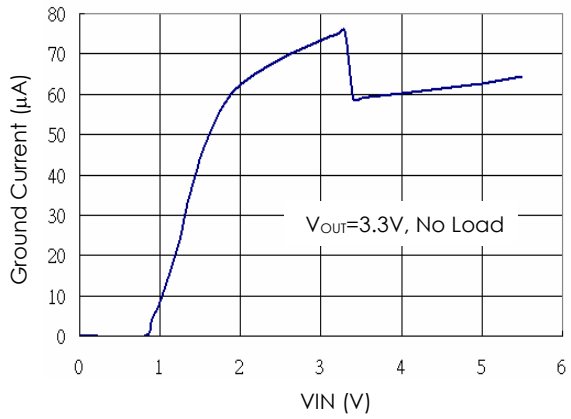
Ground Current vs. Load Current



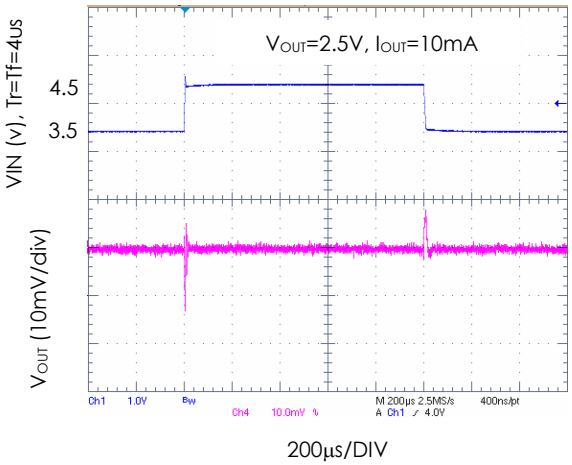
Typical Performance Characteristics

Unless otherwise specified, VIN = $V_{OUT\ (NOM)}$ + 1V, V_{EN}=V_{IN}, C_{IN} = C_{OUT} = 2.2μF, T_A = 25°C. (Continued)

Ground Current vs. VIN

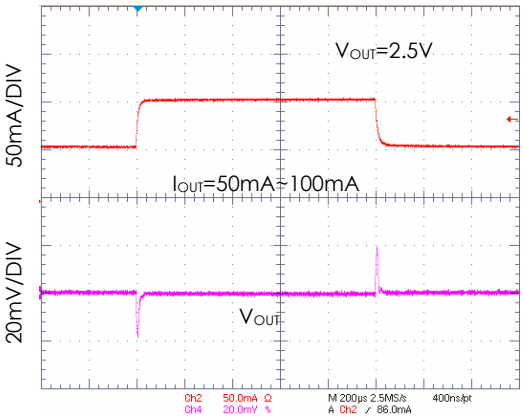


Line Transient



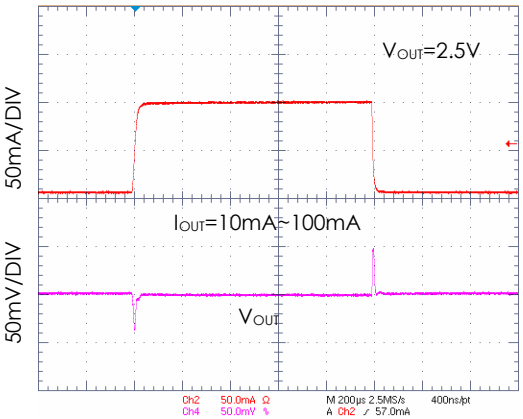
200μs/DIV

Load Transient



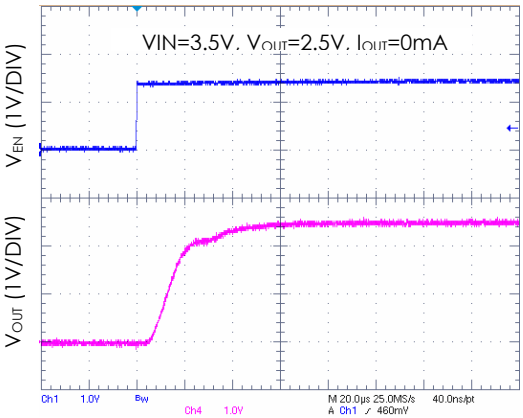
200μs/DIV

Load Transient



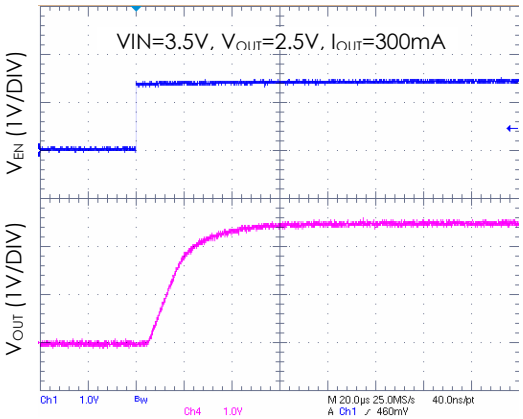
200μs/DIV

Enable Response



20μs/DIV

Enable Response

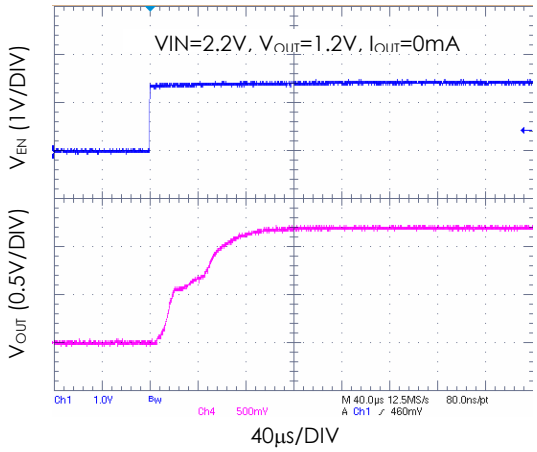


20μs/DIV

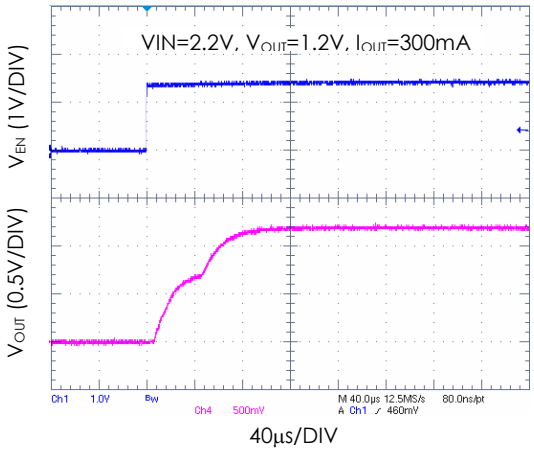
Typical Performance Characteristics

Unless otherwise specified, VIN = $V_{OUT\ (NOM)}$ + 1V, V_{EN}=V_{IN}, C_{IN} = C_{OUT} = 2.2µF, T_A = 25°C. (Continued)

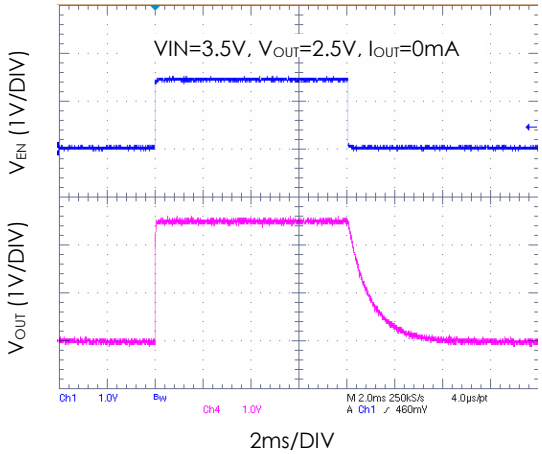
Enable Response



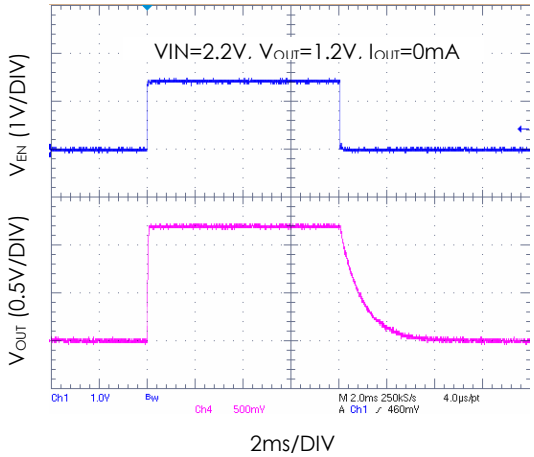
Enable Response



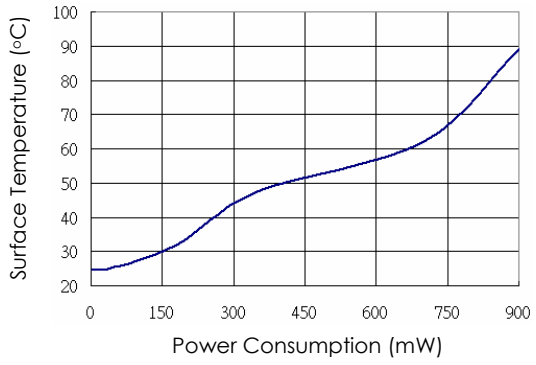
Disable Response



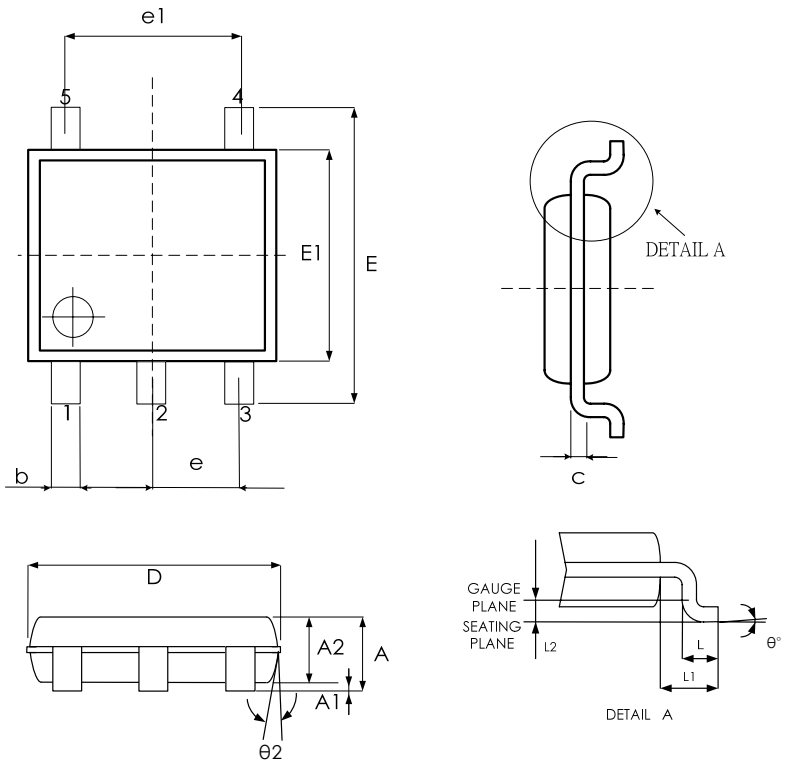
Disable Response



Power Derating (SOT-25)



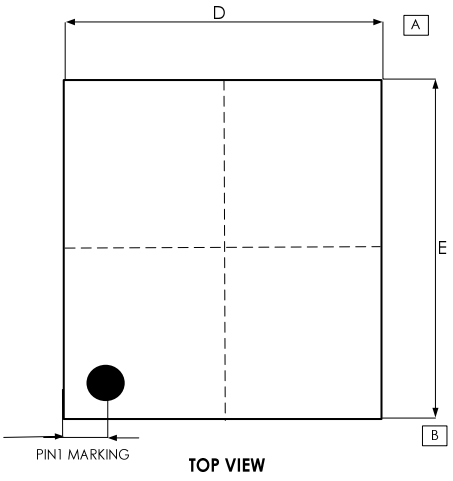
SOT-23-5



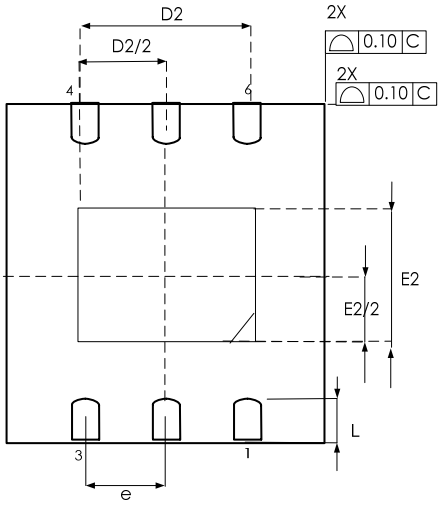
SYMBPLS	MIN.	NOM.	MAX.
A	1.05	1.20	1.35
A1	0.05	0.10	0.15
A2	1.00	1.10	1.20
b	0.30	—	0.50
c	0.08	—	0.20
D	2.80	2.90	3.00
E	2.60	2.80	3.00
E1	1.50	1.60	1.70
e	0.95 BSC		
e1	1.90 BSC		
L	0.30	0.45	0.55
L1	0.60 REF		
L2	0.25 REF		
θ°	0	5	10
θ2°	6	8	10

UNIT: MM

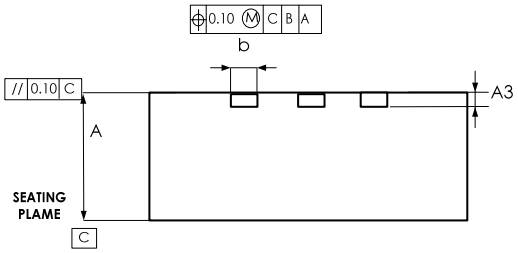
TDFN-6



TOP VIEW



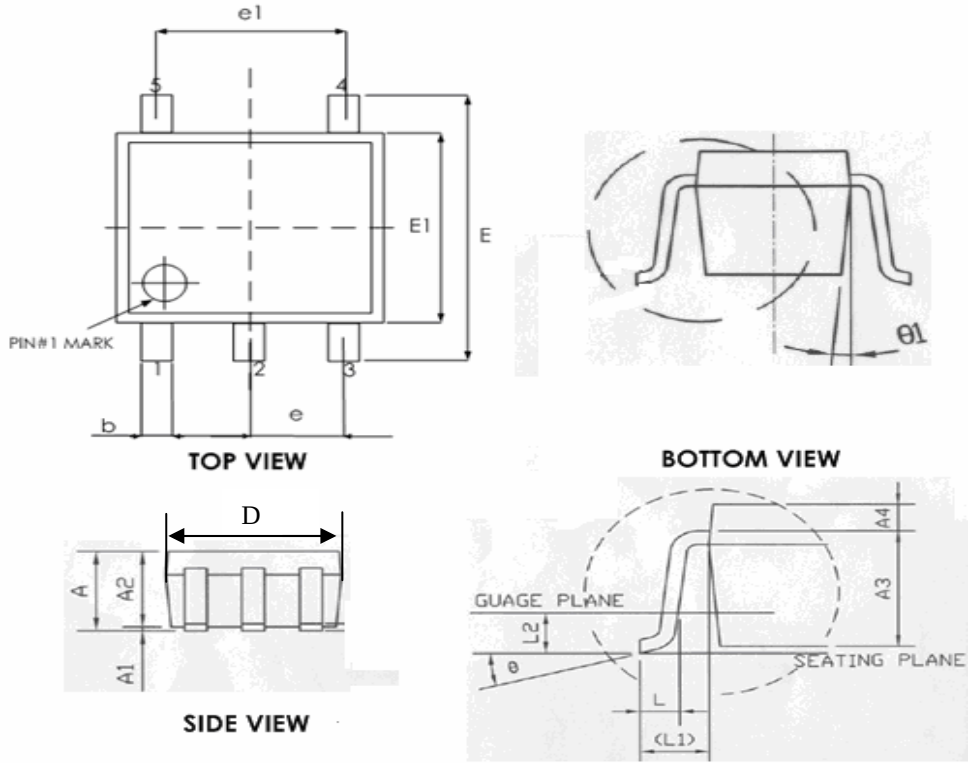
BOTTOM VIEW



SILD VIEW

SYMBOL	COMMON					
	DIMENSIONS MILLIMETER			DIMENSIONS INCH		
	MIN.	NOM.	MAX.	MIN.	NOM.	MAX.
A	0.70	0.75	0.80	0.027	0.029	0.031
A3		0.200 REF			0.008 REF	
b	0.25	0.30	0.35	0.010	0.012	0.014
D		2.00 BSC			0.079 BSC	
D2	1.20	1.30	1.40	0.046	0.050	0.054
E		2.00 BSC			0.079 BSC	
E2	0.50	0.60	0.70	0.022	0.024	0.026
e		0.650 BSC			0.026 BSC	
L	0.25	0.30	0.35	0.009	0.011	0.013

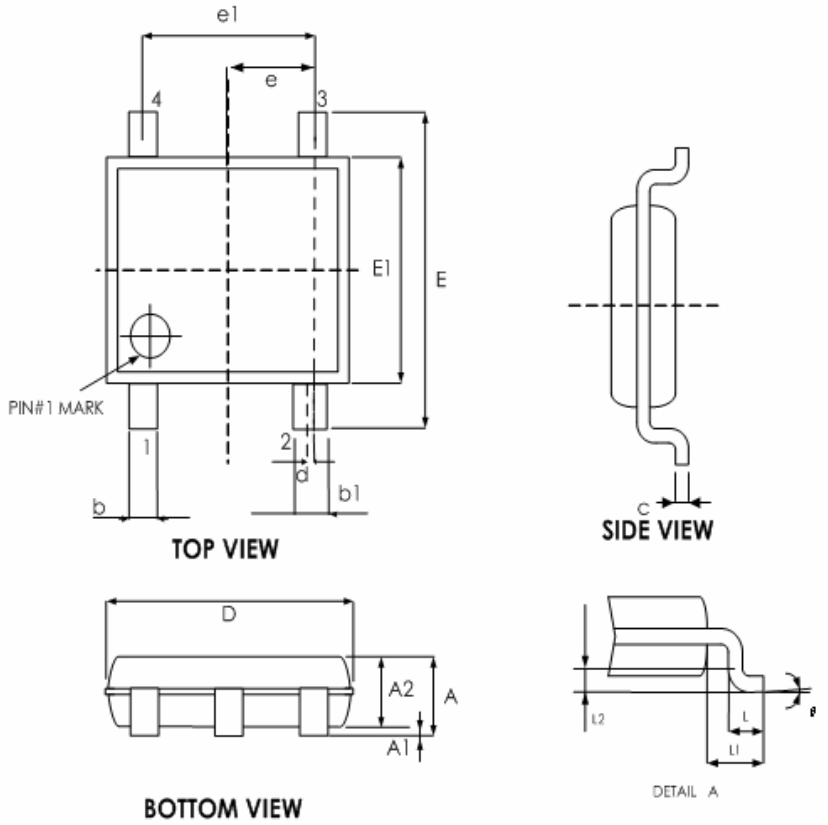
SOT-353 (SC-70-5)



SYMBPLS	MIN.	NOM.	MAX.
A	0.80	—	1.10
A1	0	—	0.10
A2	0.80	0.90	1.00
A3	0.47	0.52	0.57
A4	0.33	0.38	0.43
b	0.15	—	0.30
c	0.08	—	0.22
D	1.85	2.00	2.15
E	1.80	2.10	2.40
E1	1.10	1.25	1.40
e	0.65 BSC		
e1	1.30 BSC		
L	0.26	0.36	0.46
L1	0.42 REF		
L2	0.15 BSC		
θ°	0	4	8
θ2°	4	—	12

UNIT: MM

SOT-343



SYMBOL	COMMON			
	DIMENSIONS MILLIMETER		DIMENSIONS INCH	
	MIN.	MAX.	MIN.	MAX.
A	0.900	1.100	0.035	0.043
A1	0.000	0.100	0.000	0.004
A2	0.900	1.000	0.035	0.039
b	0.250	0.400	0.010	0.016
b1	0.350	0.500	0.014	0.020
c	0.080	0.150	0.003	0.006
d	0.050 TYP.		0.002 TYP.	
D	2.000	2.200	0.079	0.087
E	2.150	2.450	0.085	0.096
E1	1.150	1.350	0.045	0.053
e	0.650 TYP.		0.026 TYP.	
e1	1.200	1.400	0.047	0.055
L	0.260	0.460	0.010	0.018
L1	0.525 TYP.		0.021 TYP.	
L2	0.250 TYP.		0.010 TYP.	

Revision History

Revision	Date	Description
2.0	2009.05.08	EMP transferred from version 1.3
2.1	2009.06.23	1. Delete FBP-6 & SOT-343 package (page 2) 2. Delete FBP-6 & SOT-343 order information (page 3) 3. Add order information SOT-23-5 Vout 1.2V、1.3V(page 3) 4. Add SOT-353 package type (page 2) 5. Add order information SOT-353 Vout 1.2V~3.3V (page 3) 6. Delete FBP-6 & SOT-343 outline drawing (page 10~13) 7. Add SOT-353 outline drawing (page 10~13)
2.2	2010.01.13	1. Delete/Add some content in general description part (page 1) 2. Delete SOT-23-5 NRR package (page 2) 3. SC70-5 revised as SC-70-5 (page 2) 4. Add SOT-343 connection diagram & order information (page 2) 5. Add order, mark & packing information of SOT-343 (page 4) 6. SOT-343/SOT353 (page 5) 7. Add outline drawing of SOT-343 (page 13)
2.3	2011.03.18	Add D marking for SOT353 package in page12

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