

## 45V, 350mA Low Dropout Voltage Linear Regulator

### Features

- \* High Input Voltage Range: Up to 55V
- \* Maximum Output Current: 350mA
- \* Low Quiescent Current: 2.1uA
- \* Low Dropout Voltage: 350mV@100mA
- \* High PSRR: 85dB at 1KHz
- \* Fixed Output Voltages: 1.8V, 2.8V, 3V, 3.3V, 5V, 6V
- \* Fast Transient Response
- \* Current Limiting Protection
- \* Thermal Shutdown Protection
- \* Totally Lead-Free & Fully RoHS Compliant
- \* Halogen and Antimony Free. "Green" Device

### Applications

- \* Battery-Powered Equipment
- \* Smoke Detector and Sensor
- \* Micro Controller Applications
- \* Handset Peripherals
- \* Audio/Video Equipment

### General Description

The HCR2454 Series is a high input voltage, low quiescent current low-dropout linear regulator able to provide 300mA load current. The LDO features very fast response against line voltage transient and load current transient, and ensures no overshoot voltage during the LDO start-up and short circuit recovery.

The HCR2454 allows input voltage as high as 55V. Thus, The device features integrated short-circuit and thermal shutdown protection.

The HCR2454 is available in SOT-23, SOT-23-5, SOT-89-3, SOT-89-5 and DFN-1x1-4L packages. It operates over an ambient temperature range of -40°C to +85°C.

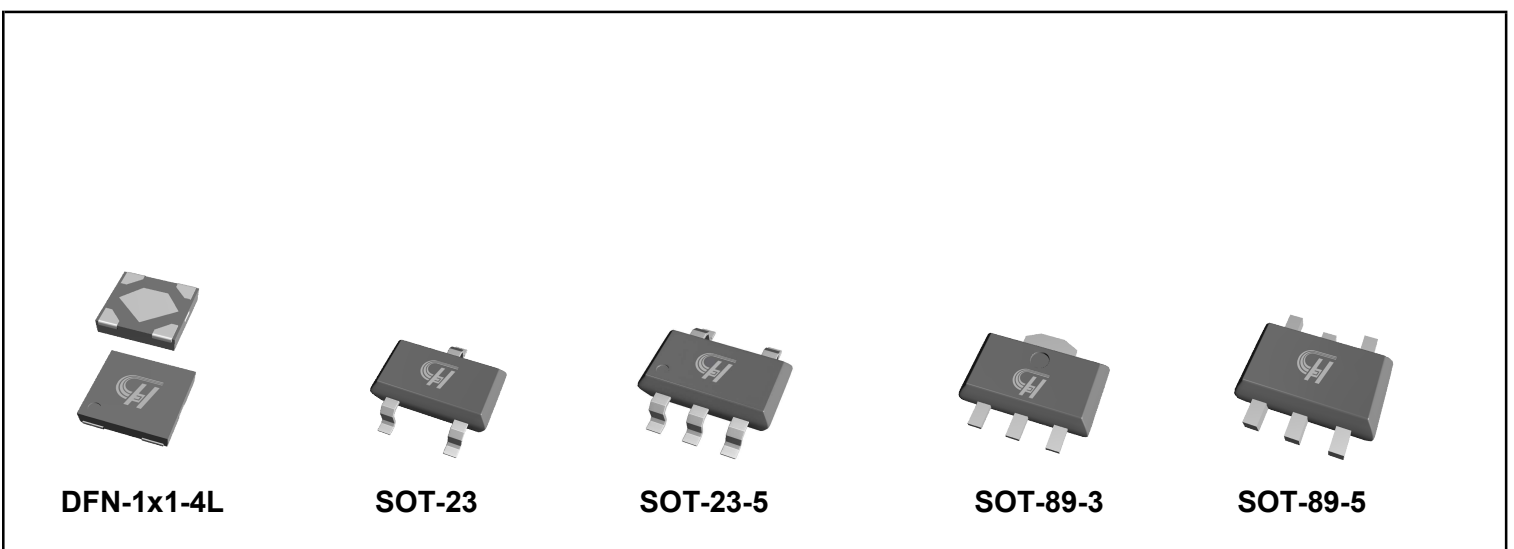


Figure 1. Package Type of HCR2454

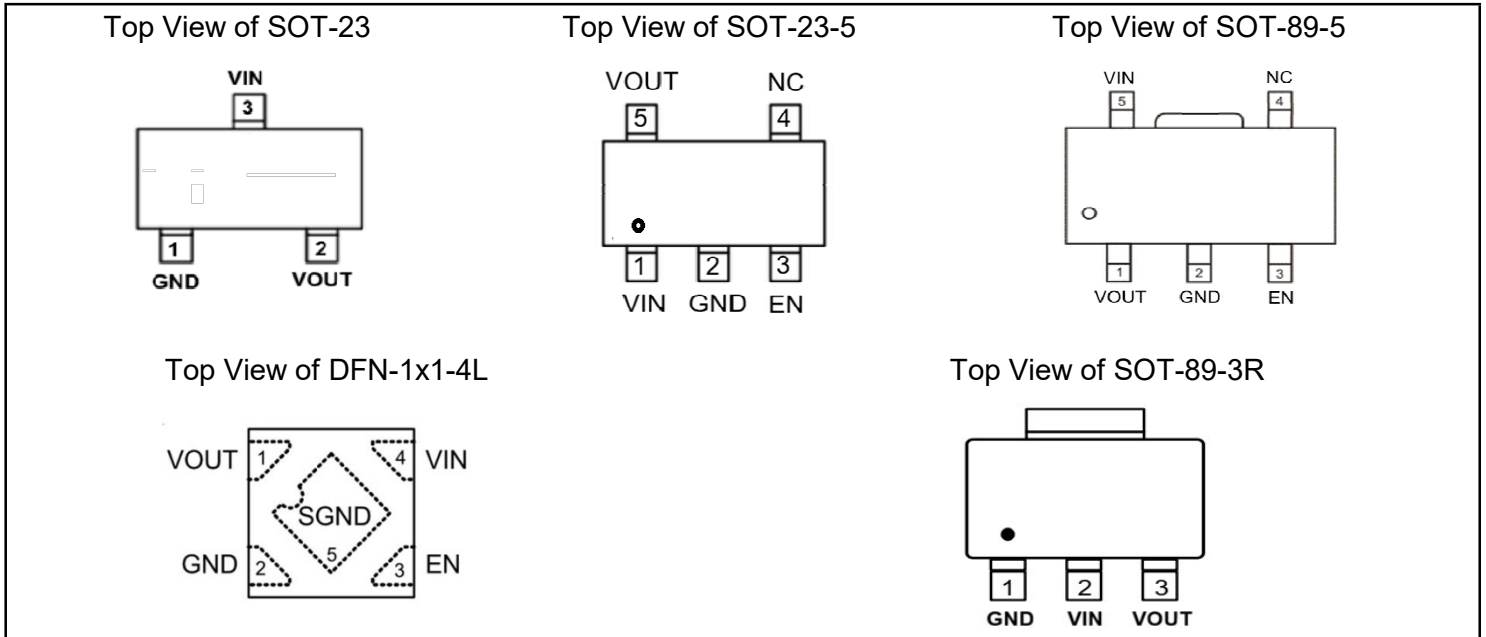
**45V, 350mA Low Dropout Voltage Linear Regulator**
**Pin Configuration**


Figure 2. Pin Configuration of HCR2454 (Top View)

**Pin Description**

Package					Pin Name	Pin Function
SOT-23-5	SOT-89-3R	SOT-89-5	DFN-1x1-4L	SOT-23		
1	2	5	4	3	VIN	Regulator Input. Up to 55V input Voltage. At least 1uF supply bypass capacitor is recommended.
2	1	2	2	1	GND	Ground
3	-	3	3	-	EN	Chip Enable(Active High). Note that this pin is high impedance
4	-	4	-	-	NC	No Connected for fixed version
5	3	1	1	2	VOUT	Regulated Output. Recommended output capacitor range:1uF to 10uF.

**Typical Application**

-- HCR2454 Fixed Version for SOT-23, SOT-23-5, SOT-89-3R. SOT-89-5 and DFN-1x1-4L packing

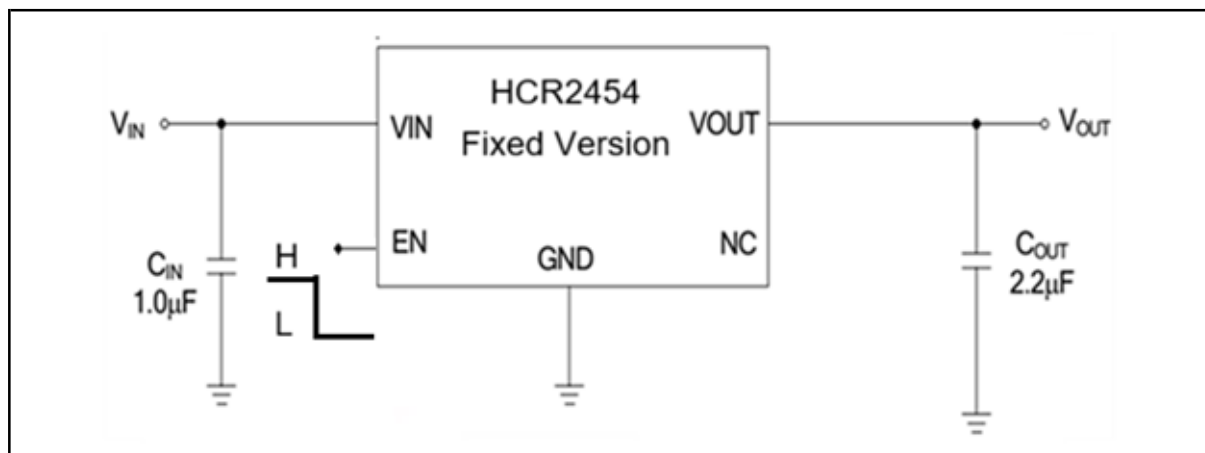
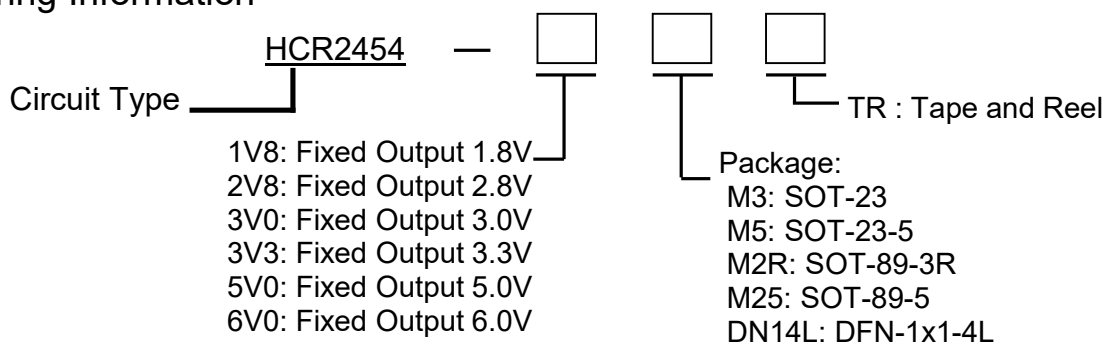


Figure 3. Typical Application of HCR2454

**45V, 350mA Low Dropout Voltage Linear Regulator**
**Ordering Information**


Standard	Marking	Voltage	Package	MSL Level	Shipping
HCR2454-1V8M3TR	5418	1.8V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-2V8M3TR	5428	2.8V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-3V0M3TR	5430	3.0V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-3V3M3TR	5433	3.3V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-5V0M3TR	5450	5.0V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-6V0M3TR	5460	6.0V	SOT-23	MSL1	3000, Tape&Reel
HCR2454-1V8M5TR	5418E	1.8V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-2V8M5TR	5428E	2.8V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-3V0M5TR	5430E	3.0V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-3V3M5TR	5433E	3.3V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-5V0M5TR	5450E	5.0V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-6V0M5TR	5460E	6.0V	SOT-23-5	MSL1	3000, Tape&Reel
HCR2454-1V8M2RTR	5418	1.8V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-2V8M2RTR	5428	2.8V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-3V0M2RTR	5430	3.0V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-3V3M2RTR	5433	3.3V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-5V0M2RTR	5450	5.0V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-6V0M2RTR	5460	6.0V	SOT-89-3R	MSL1	1000, Tape&Reel
HCR2454-1V8M25TR	5418	1.8V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-2V8M25TR	5428	2.8V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-3V0M25TR	5430	3.0V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-3V3M25TR	5433	3.3V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-5V0M25TR	5450	5.0V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-6V0M25TR	5460	6.0V	SOT-89-5	MSL1	1000, Tape&Reel
HCR2454-1V8DN14LTR	5418	1.8V	DFN-1x1-4L	MSL1	10000, Tape&Reel
HCR2454-2V8DN14LTR	5428	2.8V	DFN-1x1-4L	MSL1	10000, Tape&Reel
HCR2454-3V0DN14LTR	5430	3.0V	DFN-1x1-4L	MSL1	10000, Tape&Reel
HCR2454-3V3DN14LTR	5433	3.3V	DFN-1x1-4L	MSL1	10000, Tape&Reel
HCR2454-5V0DN14LTR	5450	5.0V	DFN-1x1-4L	MSL1	10000, Tape&Reel
HCR2454-6V0DN14LTR	5460	6.0V	DFN-1x1-4L	MSL1	10000, Tape&Reel

**45V, 350mA Low Dropout Voltage Linear Regulator**
**Absolute Maximum Ratings** <sup>Note 1</sup>

Parameter		Symbol	Value		Unit
Supply Input Voltage	V <sub>IN</sub> to GND	V <sub>IN</sub>	-0.3 ~ +55		V
	V <sub>OUT</sub> to GND Voltage		-0.3 ~ +6V		
	V <sub>OUT</sub> to V <sub>IN</sub> Voltage		-55 ~ +0.3		
	EN to GND Voltage		-0.3 ~ +55		
Output Current		I <sub>OUT</sub>	Internally Limited		-
Power Dissipation <sup>note2</sup>		P <sub>D</sub>	SOT-23	320	mW
			SOT-23-5	500	mW
			SOT-89-3R	920	mW
			SOT-89-5	920	mW
			DFN-1x1-4L	500	mW
Thermal Resistance (Junction to Ambient)		θ <sub>JA</sub>	SOT-23	380	°C/W
			SOT-23-5	250	°C/W
			SOT-89-3R	135	°C/W
			SOT-89-5	135	°C/W
			DFN-1x1-4L	250	°C/W
Junction Temperature		T <sub>J(Max)</sub>	150		°C
Operating Ambient Temperature		T <sub>a</sub>	-40 ~ +85		°C
Storage Temperature Range		T <sub>STG</sub>	-40 ~ +150		°C
Lead Temperature(Soldering, 10sec)		T <sub>LEAD</sub>	260		°C

Note 1: Stresses greater than those listed under " Absolute Maximum Ratings " may cause permanent damage to the device. There are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under " Recommended Operating Conditions " is not implied. Exposure to " Absolute Maximum Ratings "for extended periods may affect device reliability .

2: PD(MAX): Internally Limited

**Recommended Operating Conditions**

Parameter	Symbol	Min	Max	Unit
Supply Input Voltage	V <sub>IN</sub>	3.0	45	V
Maximum Output Current	I <sub>O</sub>	-	350	mA
Operating Ambient Temperature	T <sub>a</sub>	-40	+85	°C

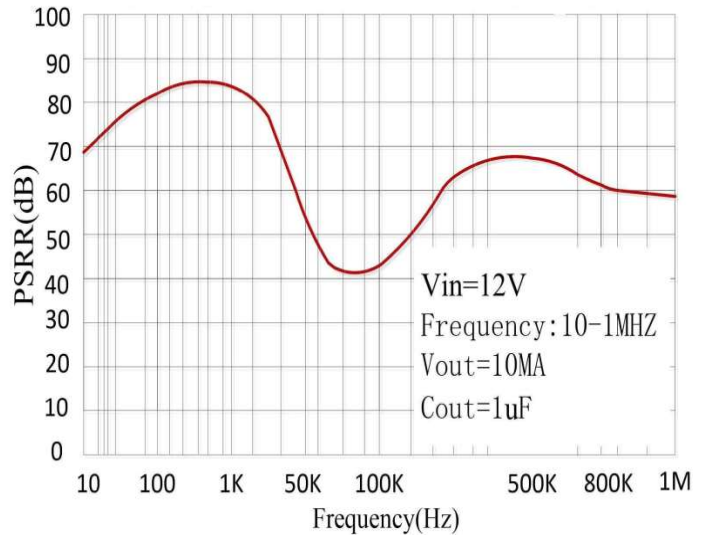
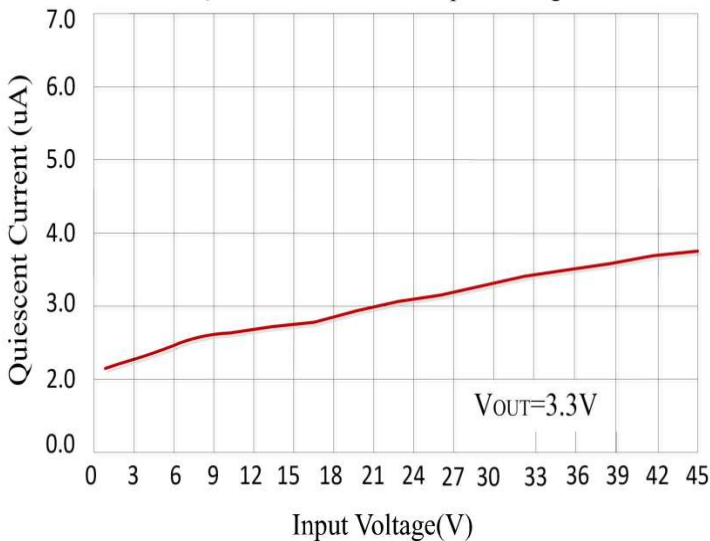
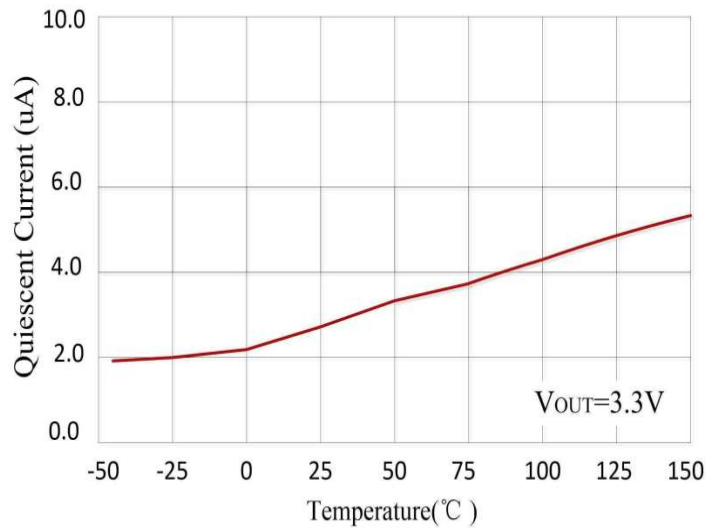
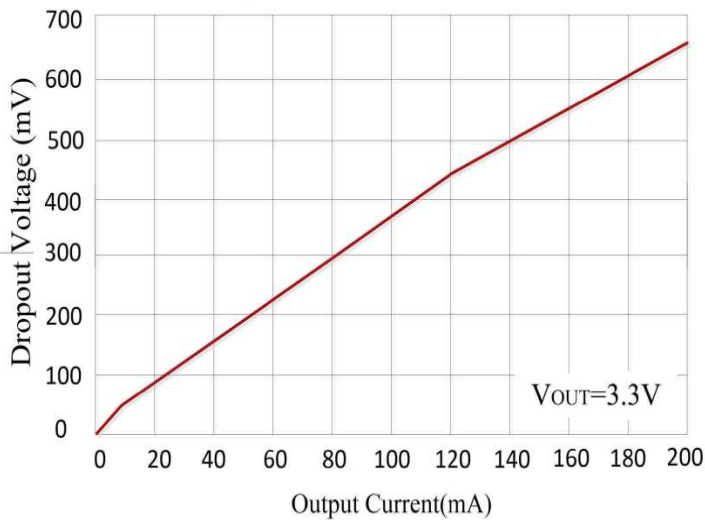
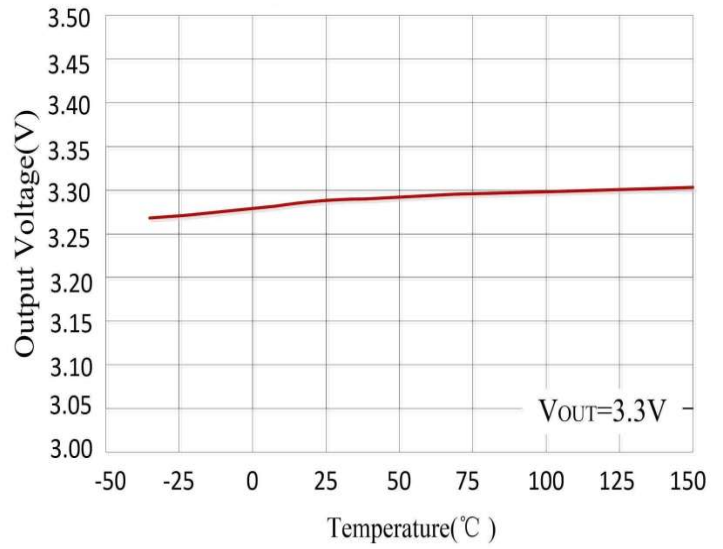
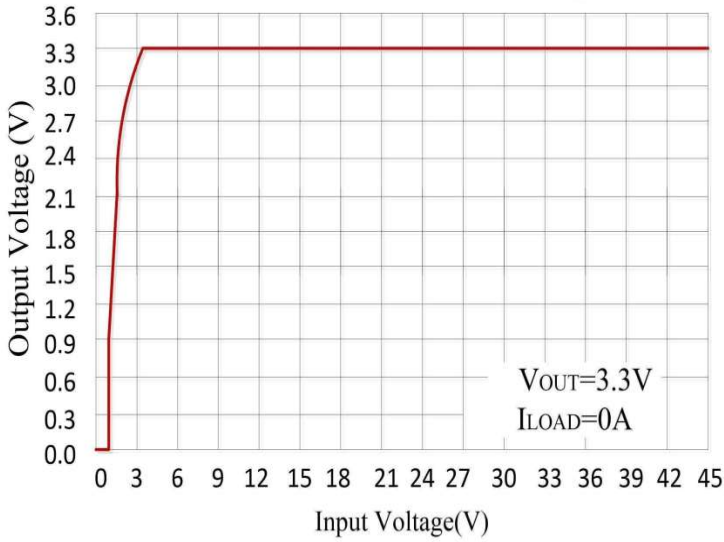
**45V, 350mA Low Dropout Voltage Linear Regulator**
**Electrical Characteristics**

 (  $V_{in}=V_{out} + 1V$  ,  $T_A=25\text{ }^{\circ}\text{C}$  ,  $C_{IN}=1\mu\text{F}$  ,  $C_{OUT}=10\mu\text{F}$  , unless other-wise specified. )

Parameter	Symbol	Condition	Min	Type	Max	Unit
Input Voltage	$V_{IN}$	-	3.0	-	45	V
Output Voltage	$V_{OUT}$	$V_{OUT}=1.8V/2.8V/3.0V/3.3V/5V/6V$ as reference, $V_{IN}=12V$ , $I_{OUT}=10mA$	$V_{OUT} \times 98\%$	-	$V_{OUT} \times 102\%$	V
Quiescent Current	$I_Q$	$V_{IN}=12V$ , $I_{OUT}=0mA$	-	2.1	-	$\mu\text{A}$
Maximum Output Current	$I_{OUT\_Max}$	-	300	350	-	mA
Dropout Voltage <sup>note3</sup>	$V_{DROP}$	$V_{IN}=V_{OUTNOM}-0.1V$ , $I_{OUT}=10mA$	-	35	-	mV
		$V_{IN}=V_{OUTNOM}-0.1V$ , $I_{OUT}=100mA$	-	350	-	
Line Regulation	$\Delta V_{LINE}$	$V_{OUTNOM}+0.5V \leq V_{IN} \leq 40V$ , $I_{OUT}=1mA$	-	0.01	-	%/V
Load Regulation	$\Delta V_{LOAD}$	$1mA < I_{OUT} < 100mA$ , $V_{in}=12V$	-	0.02	-	%/mA
Current Limit	$I_{LIM}$	-	-	500	-	mA
EN Input Threshold	$V_{IL}$	Logic Low	-	-	0.4	V
	$V_{IH}$	Logic High	1.0	-	-	V
Output Noise Voltage	$V_{NOISE}$	10Hz~100KHz, $C_{OUT}=1\mu\text{F}$ , $V_{OUT}=3V$	-	110	-	$\mu\text{VRMS}$
Power Supply Rejection Ration	PSRR	$V_{IN}=12V$ , $I_{OUT}=10mA$ , $f=1KHz$ , $V_{OUT}=3.3V$	-	85	-	dB
<b>THERMAL PROTECTION</b>						
Thermal Shoutdown Temperature	TSHDN	Shutdown, Temp increasing	-	150	-	$^{\circ}\text{C}$
Thermal Reset Temperature	TSHDN	Reset, Temp Increasing	-	140	-	$^{\circ}\text{C}$
Thermal Shoutdown Hysteresis	$\Delta T_{SHDN}$		-	20	-	$^{\circ}\text{C}$

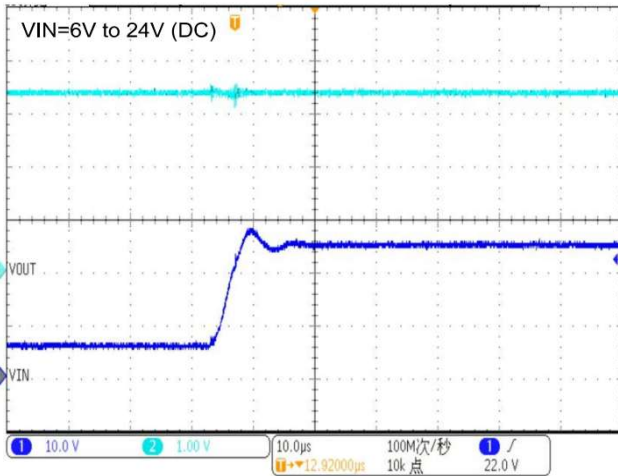
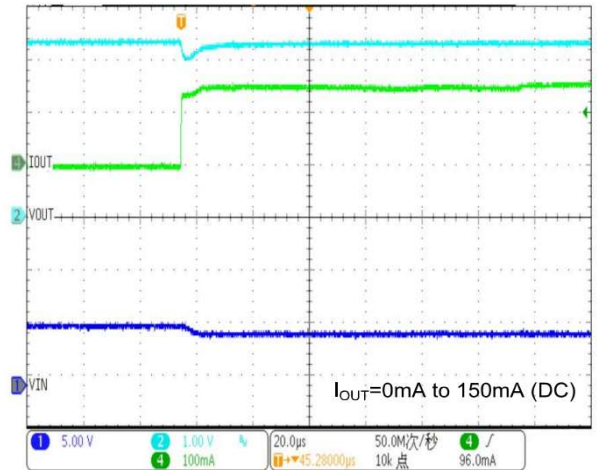
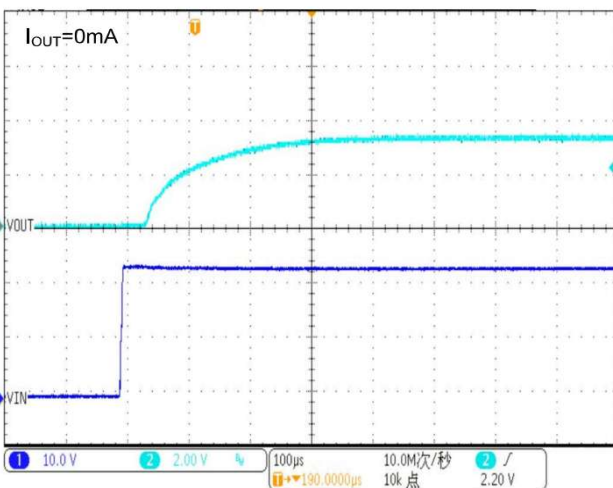
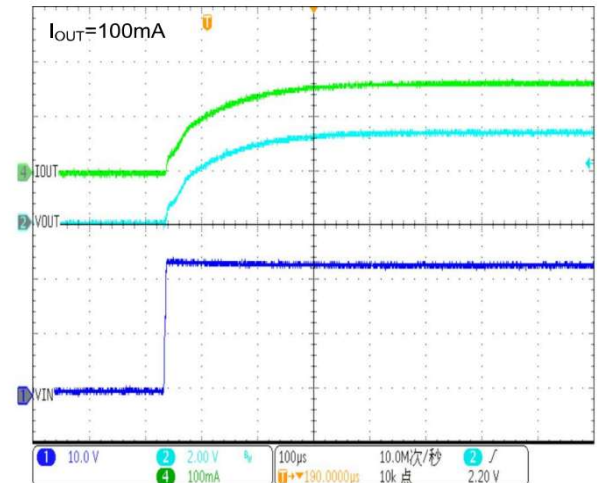
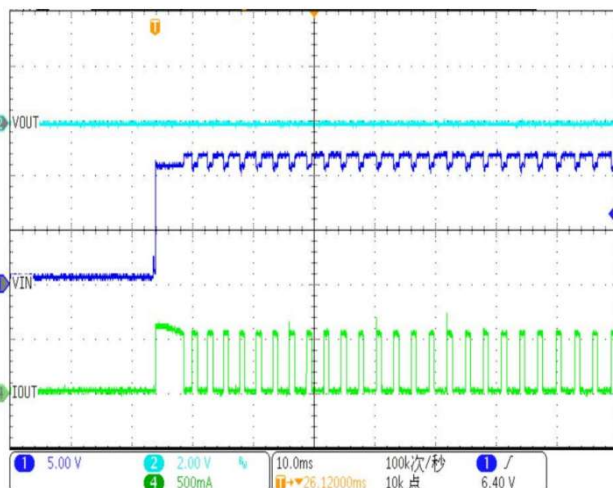
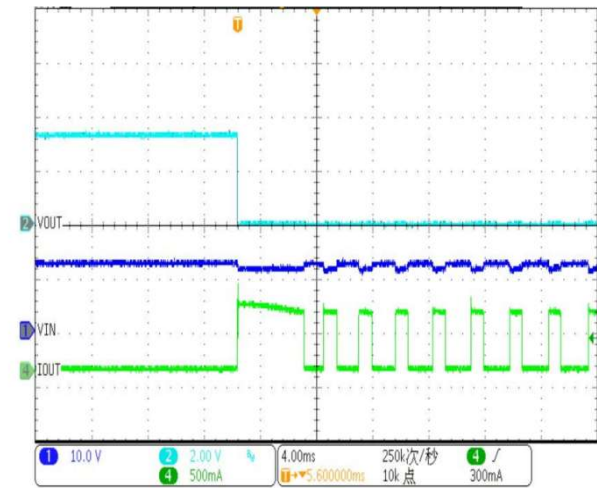
Note 3. The dropout voltage difference is the voltage difference between the input and output, where the output voltage is 2% lower than its nominal value.

**45V, 350mA Low Dropout Voltage Linear Regulator**
**Typical Performance Characteristics**

 Test Condition:  $T_a=25^\circ\text{C}$ ,  $I_{\text{out}}=1\text{mA}$ ,  $C_{\text{out}}=10\mu\text{F}$ , unless otherwise noted


**45V, 350mA Low Dropout Voltage Linear Regulator**
**Typical Performance Characteristics(Con.)**

 Test Condition:  $T_a=25^{\circ}\text{C}$ ,  $I_{out}=1\text{mA}$ ,  $C_{out}=10\mu\text{F}$ , unless otherwise noted

**Line transient**

**Load transient**

**No-load start**

**Start with load**

**Short-circuit Power-on**

**Power-on short**


## 45V, 350mA Low Dropout Voltage Linear Regulator

### Functional Block Diagrams

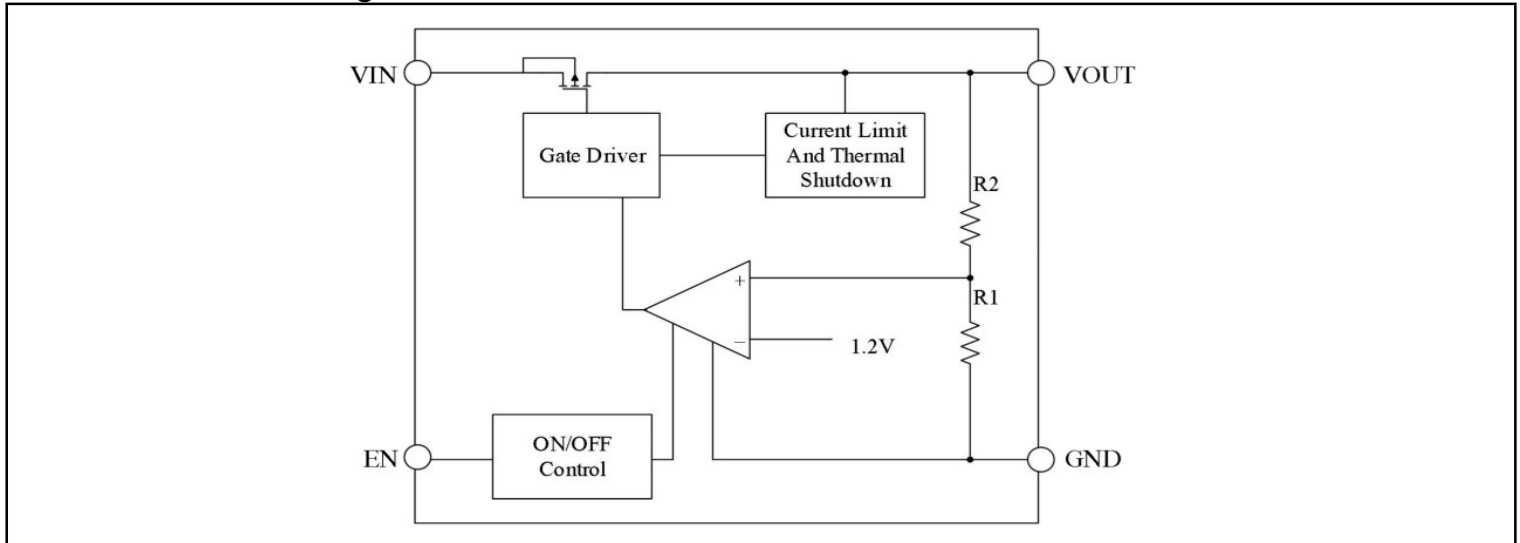


Figure 4. Functional Block Diagrams of HCR2454

### Applications Information

#### Input Capacitor

A 1 $\mu$ F ceramic capacitor is recommended to connect between VIN and GND pins to decouple input power supply glitch and noise. The amount of the capacitance may be increased without limit. This input capacitor must be located as close as possible to the device to assure input stability and less noise. For PCB layout, a wide copper trace is required for both VIN and GND.

#### Output Capacitor

An output capacitor is required for the stability of the LDO. The recommended minimum output capacitance is 10 $\mu$ F, ceramic capacitor is recommended, and temperature characteristics are X7R or X5R. Higher capacitance values help to improve load/line transient response. The output capacitance may be increased to keep low undershoot/overshoot, Place output as close as possible to VOUT and GND pins.

#### EN Pin Operation

The HCR2454 series is turned on by setting the EN pin to "H", Since the EN pin is neither puller down nor pulled

up internally, do not set it in floating status. When the EN pin is not used, connect the EN pin with VIN to keep the LDO in operating mode.

#### Current Limit and Short Circuit Protection

When output current at VOUT pin is higher than current limit threshold or the VOUT pin is direct short to GND, The current limit protection will be triggered and clamp the output current at pre-designed level to prevent over-current and thermal damage.

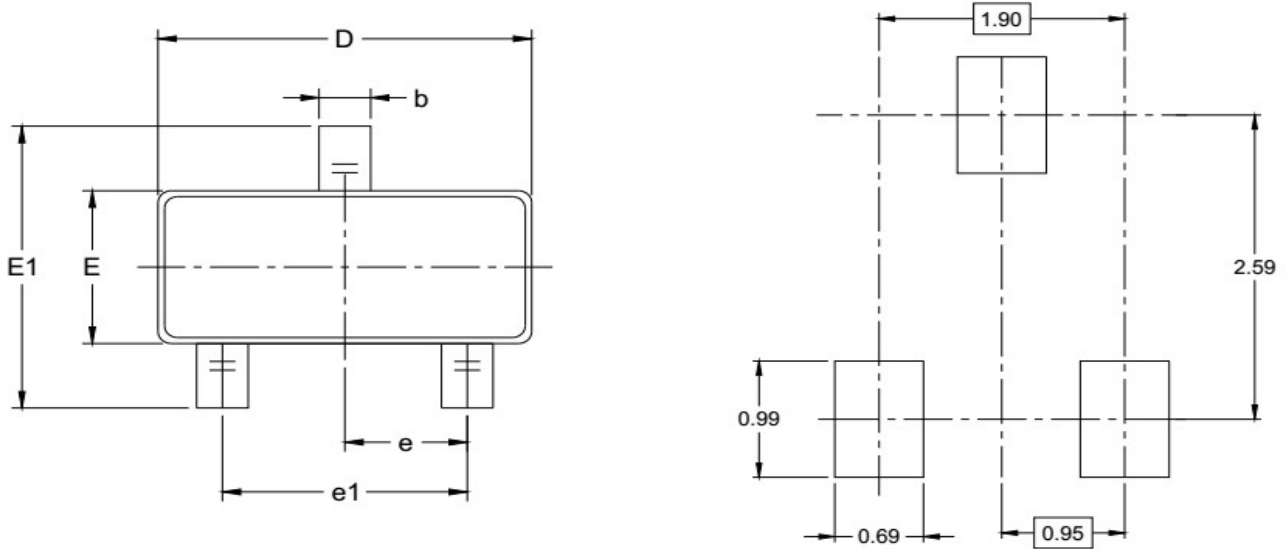
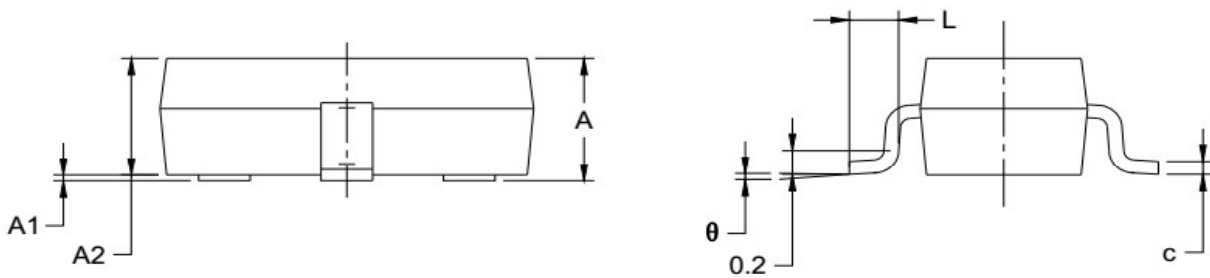
#### Thermal Protection

The HCR2454 series has internal thermal sense and protection circuits. When excessive power dissipation happens on the device, such as short circuit at the output pin or very heavy load current with a large voltage drop across the device. The internal thermal protection circuit will be triggered, and it will shutdown the power MOSFET to prevent the LDO from damage. As soon as excessive thermal condition is removed and the temperature of the device drops down, the thermal protection circuit will lease the control of the power MOSFET and the LDO device goes to normal operation.

**45V, 350mA Low Dropout Voltage Linear Regulator**
**Package Outline Dimensions**

SOT-23 (M3)

Unit: mm

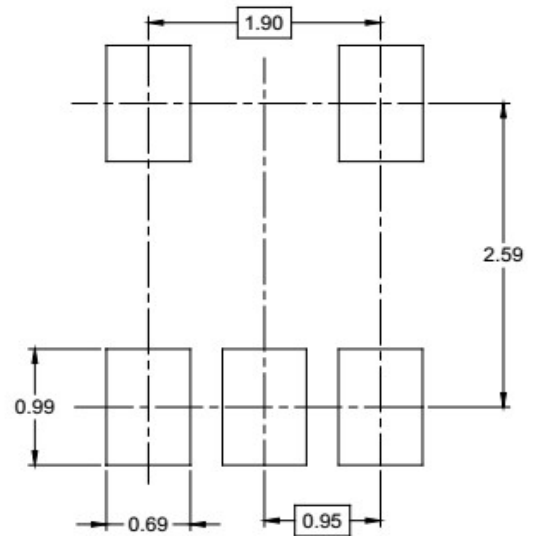
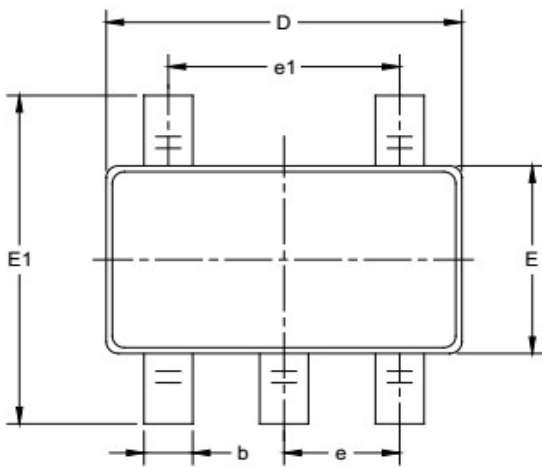
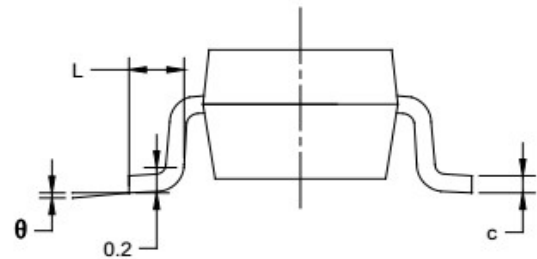
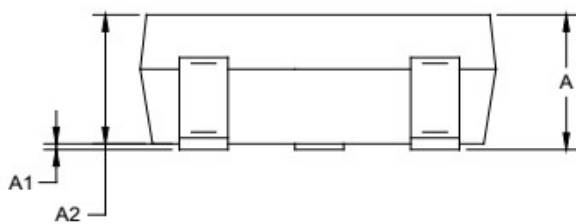

**RECOMMENDED LAND PATTERN (Unit: mm)**


Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
θ	0°	8°	0°	8°

**45V, 350mA Low Dropout Voltage Linear Regulator**
**Package Outline Dimensions(con.)**

SOT-23-5 (M5)

Unit: mm


**RECOMMENDED LAND PATTERN (Unit: mm)**


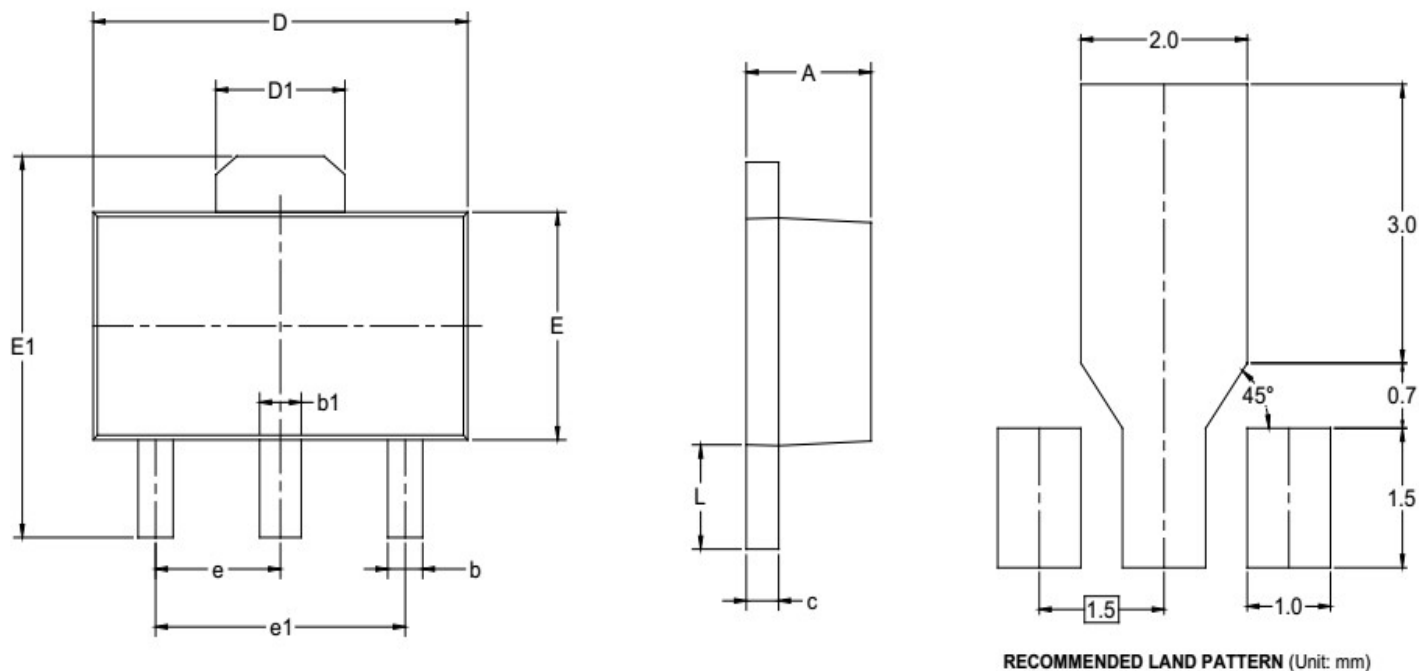
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.050	1.250	0.041	0.049
A1	0.000	0.100	0.000	0.004
A2	1.050	1.150	0.041	0.045
b	0.300	0.500	0.012	0.020
c	0.100	0.200	0.004	0.008
D	2.820	3.020	0.111	0.119
E	1.500	1.700	0.059	0.067
E1	2.650	2.950	0.104	0.116
e	0.950 BSC		0.037 BSC	
e1	1.900 BSC		0.075 BSC	
L	0.300	0.600	0.012	0.024
$\theta$	0°	8°	0°	8°

**45V, 350mA Low Dropout Voltage Linear Regulator**

## Package Outline Dimensions ( Con. )

SOT-89-3R(M2R)

Unit: mm



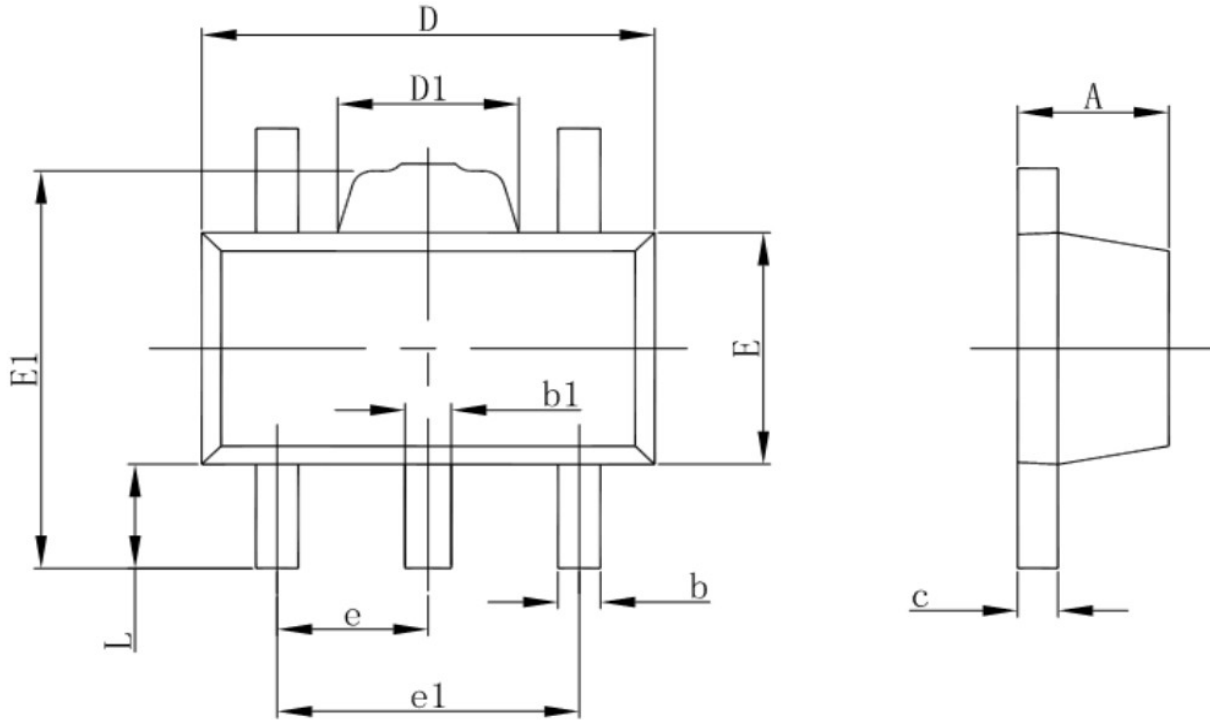
Symbol	Dimensions In Millimeters		Dimensions In Inches	
	MIN	MAX	MIN	MAX
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.400	0.580	0.016	0.023
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.550 REF		0.061 REF	
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500 TYP		0.060 TYP	
e1	3.000 TYP		0.118 TYP	
L	0.900	1.200	0.035	0.047

**45V, 350mA Low Dropout Voltage Linear Regulator**

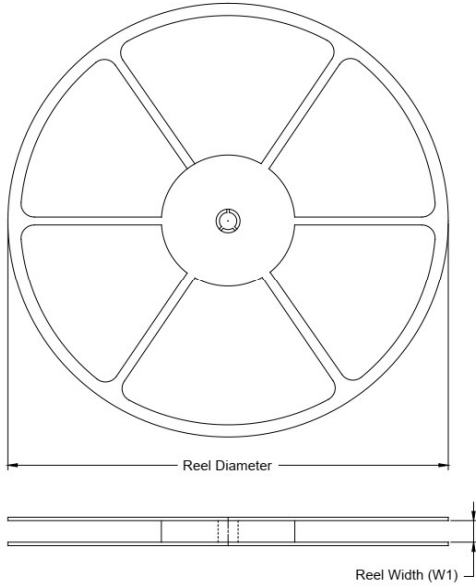
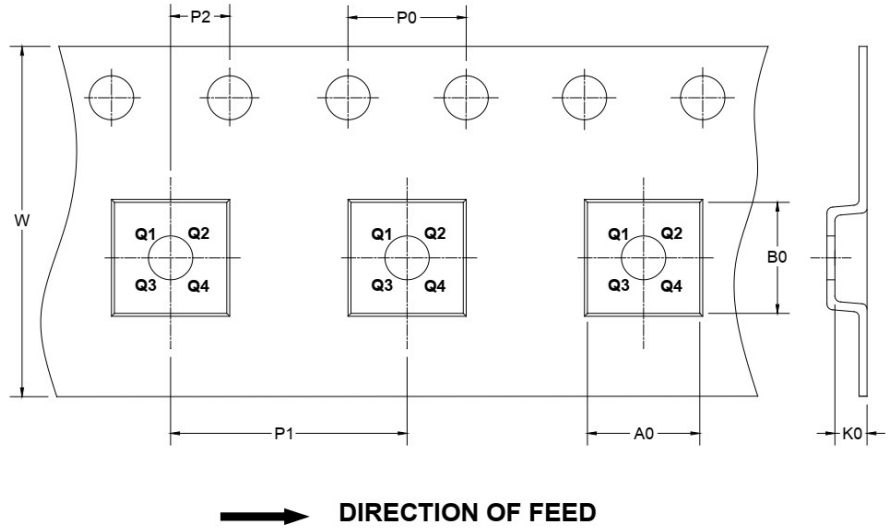
Package Outline Dimensions ( Con. )

SOT-89-5(M25)

Unit: mm



Symbol	Dimensions In Millimeters		Dimensions In Inches	
	Min.	Max.	Min.	Max.
A	1.400	1.600	0.055	0.063
b	0.320	0.520	0.013	0.020
b1	0.360	0.560	0.014	0.022
c	0.350	0.440	0.014	0.017
D	4.400	4.600	0.173	0.181
D1	1.400	1.800	0.055	0.071
E	2.300	2.600	0.091	0.102
E1	3.940	4.250	0.155	0.167
e	1.500TYP.		0.060TYP.	
e1	2.900	3.100	0.114	0.122
L	0.900	1.100	0.035	0.043

**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


NOTE: The picture is only for reference. Please make the object as the standard.

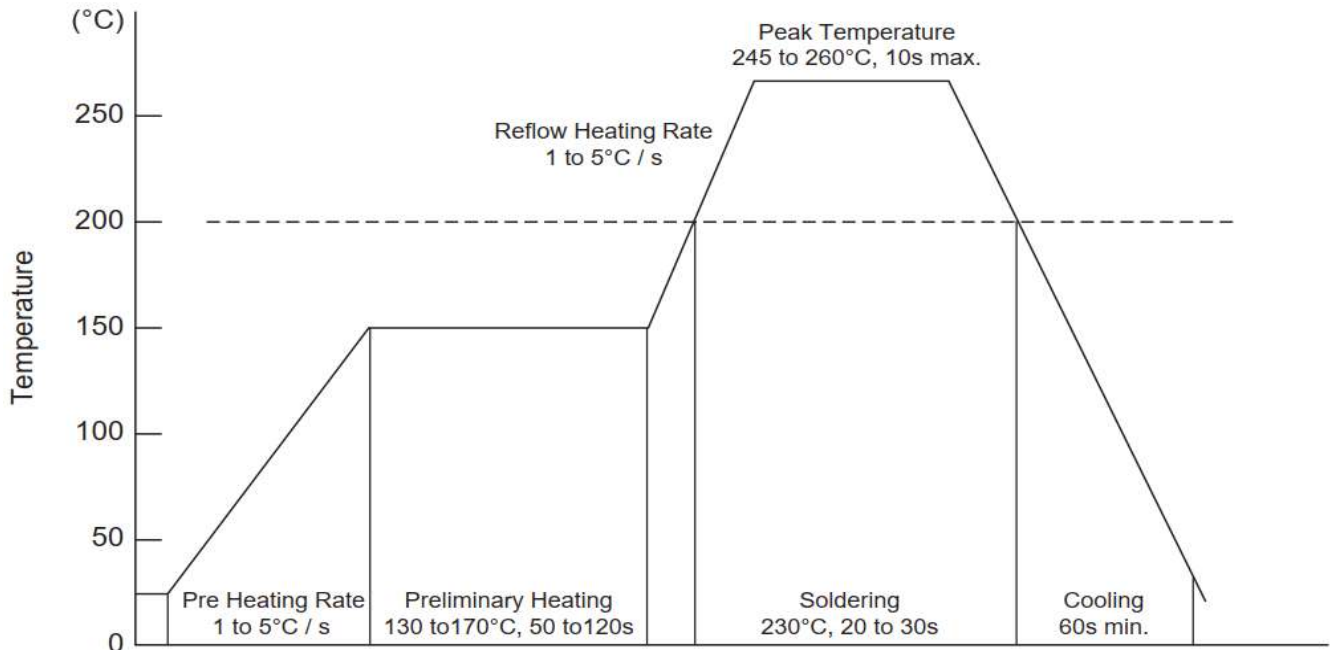
**KEY PARAMETER LIST OF TAPE AND REEL**

Package Type	Reel Diameter	Reel Width W1 (mm)	A0 (mm)	B0 (mm)	K0 (mm)	P0 (mm)	P1 (mm)	P2 (mm)	W (mm)	Pin1 Quadrant
SOT23-3	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT-23-5	7"	9.5	3.20	3.20	1.40	4.0	4.0	2.0	8.0	Q3
SOT-89-3	7"	13.2	4.85	4.45	1.85	4.0	8.0	2.0	12.0	Q3
SOT-89-5	7"	13.2	4.85	4.45	1.85	4.0	8.0	2.0	12.0	Q3
DFN-1x1-4L	7"	9.0	1.20	1.20	0.60	4.0	2.0	2.0	8.0	Q1

## 45V, 350mA Low Dropout Voltage Linear Regulator

### Conditions of Soldering and Storage

#### • Recommended condition of reflow soldering



Recommended peak temperature is over 245°C, if peak temperature is below 245°C, you may adjust the following parameters:

- \* Time length of peak temperature (longer)
- \* Time length of soldering (longer)
- \* Thickness of solder paste (thicker)

#### • Conditions of hand soldering

- \* Temperature : 300°C
- \* Time : 3s max
- \* Times : one time

#### • Storage conditions

- \* Temperature  
5 to 40°C
- \* Humidity  
30 to 80% RH
- \* Recommended period  
One year after manufacturing