

3A/3.4A Current-Limited Power Distribution Switches

General Description

The EMS6050 is an N-channel MOSFET high-side power switch without parasitic body diode between drain and source. The EMS6050 provides very low on-resistance as 40mΩ and continuously delivers up to 3.4A output current. The fault flag output function indicates fault conditions to the local USB controller. The other features include soft start, current limit protection, Power-On-Reset function, and over temperature protection. The EMS6050 is available in SOT23-5L package.

Features

- Wide Input Range 2.5V to 5.5V
- Low MOSFET On Resistance(40mΩ)
- 2us Short Protection Response
- Low Quiescent(65uA) & Shutdown Current
- Deglitched Open-Drain Fault Flag Output
- Reverse Current Flow Blocking
- Power On Reset Function
- Current Limit Protection
- Over Temperature Protection
- Soft Start and Fast Turn Off
- Reverse Voltage Protection
- Enable Active High or Active Low

Ordering Information

Part Number	Package	Remark
EMS6050A	SOT-23-5	3.0A Active Low
EMS6050B	SOT-23-5	3.0A Active High
EMS6050C	SOT-23-5	3.4A Active Low
EMS6050D	SOT-23-5	3.4A Active High

Applications

- USB peripheral + Type C peripheral
- Notebook & Netbook & MB
- Automotive
- Server, IPC, POS

Typical Application

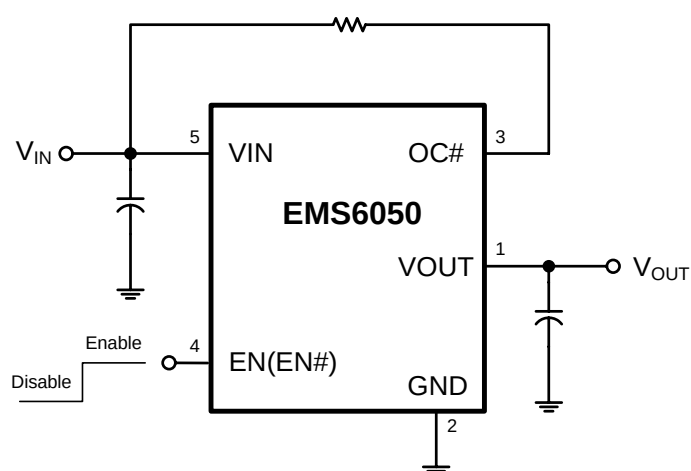
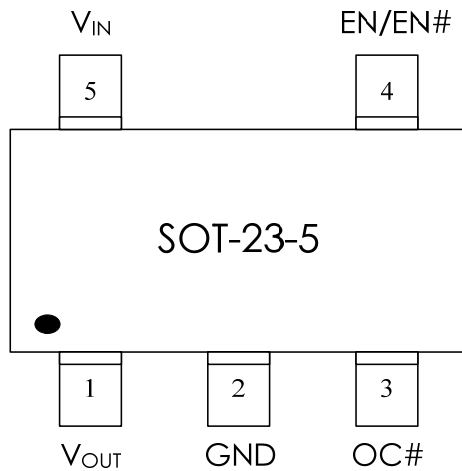


Fig. 1

Note: A low ESR 150uF capacitor between VIN, VOUT & GND is recommended.

Package Configuration



EMS6050X-VN05NRR

X Output current

VN05 SOT-23-5 Package

NRR RoHS & Halogen free package

Rating: -40 to 85°C

Package in Tape & Reel

Order, Mark & Packing information

Package	I _{out} (A)	Product ID	Marking	Packing /MPQ
SOT-23-5	3.0	EMS6050A-VN05NRR		Tape & Reel 3Kpcs
		EMS6050B-VN05NRR		
SOT-23-5	3.4	EMS6050C-VN05NRR		
		EMS6050D-VN05NRR		

Functional Block Diagram

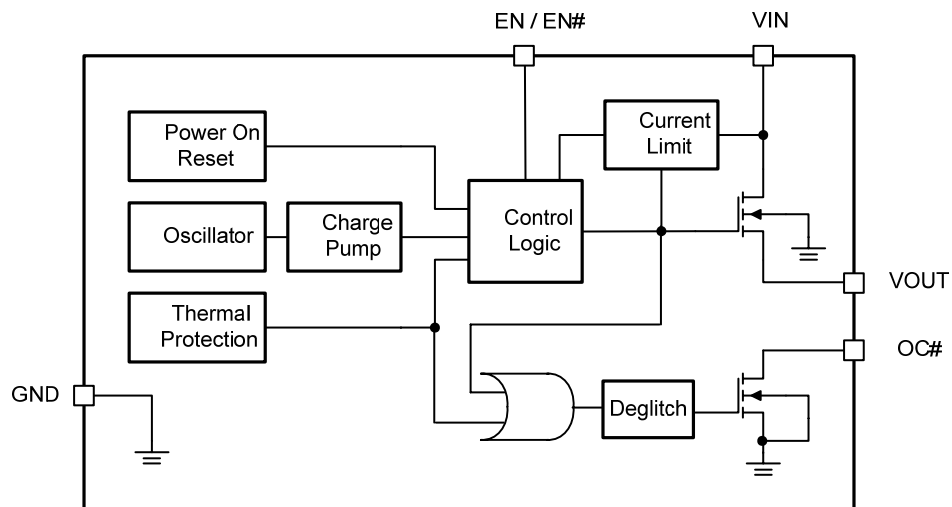


Fig. 2

Pin Functions

Pin Name	SOT-23-5	Function
VOUT	1	Output Voltage. VOUT is power output pin.
GND	2	Ground.
OC#	3	OC Flag Output. This is an open-drain output and is set low impedance once current limit or over temperature protection enabled.
EN/EN#	4	Chip Enable Input (Active high for EN, Active low for EN#)
VIN	5	Input Voltage. This is the drain input to the power device that supplies current to the output pin. Minimum 1uF low ESR ceramic capacitor is recommended at this pin.

Absolute Maximum Ratings_(Note1)

Devices are subjected to fail if they stay above absolute maximum ratings.

■ Input Voltage	-----	-0.3V to +6V
■ Other Pins	-----	-0.3V to (VIN+0.3V)
■ Power Dissipation, PD@TA=25°C, SOT-23-5	-----	0.4W
■ Package Thermal Resistance, θ_{JA} , SOT-23-5 _(Note 2)	-----	250°C/W
■ Junction Temperature	-----	150°C
■ Lead Temperature (Soldering, 10 sec.)	-----	260°C
■ Storage Temperature	-----	-65°C to 150°C
■ ESD susceptibility _(Note3)		
HBM (Human Body Mode)	-----	2KV
MM (Machine Mode)	-----	200V

Recommended Operating Conditions_(Note4)

■ Supply Input Voltage, V _{IN}	-----	+2.5V to +5.5V
■ Junction Temperature	-----	-40°C to 125°C
■ Ambient Temperature	-----	-40°C to 85°C

Electrical Characteristics

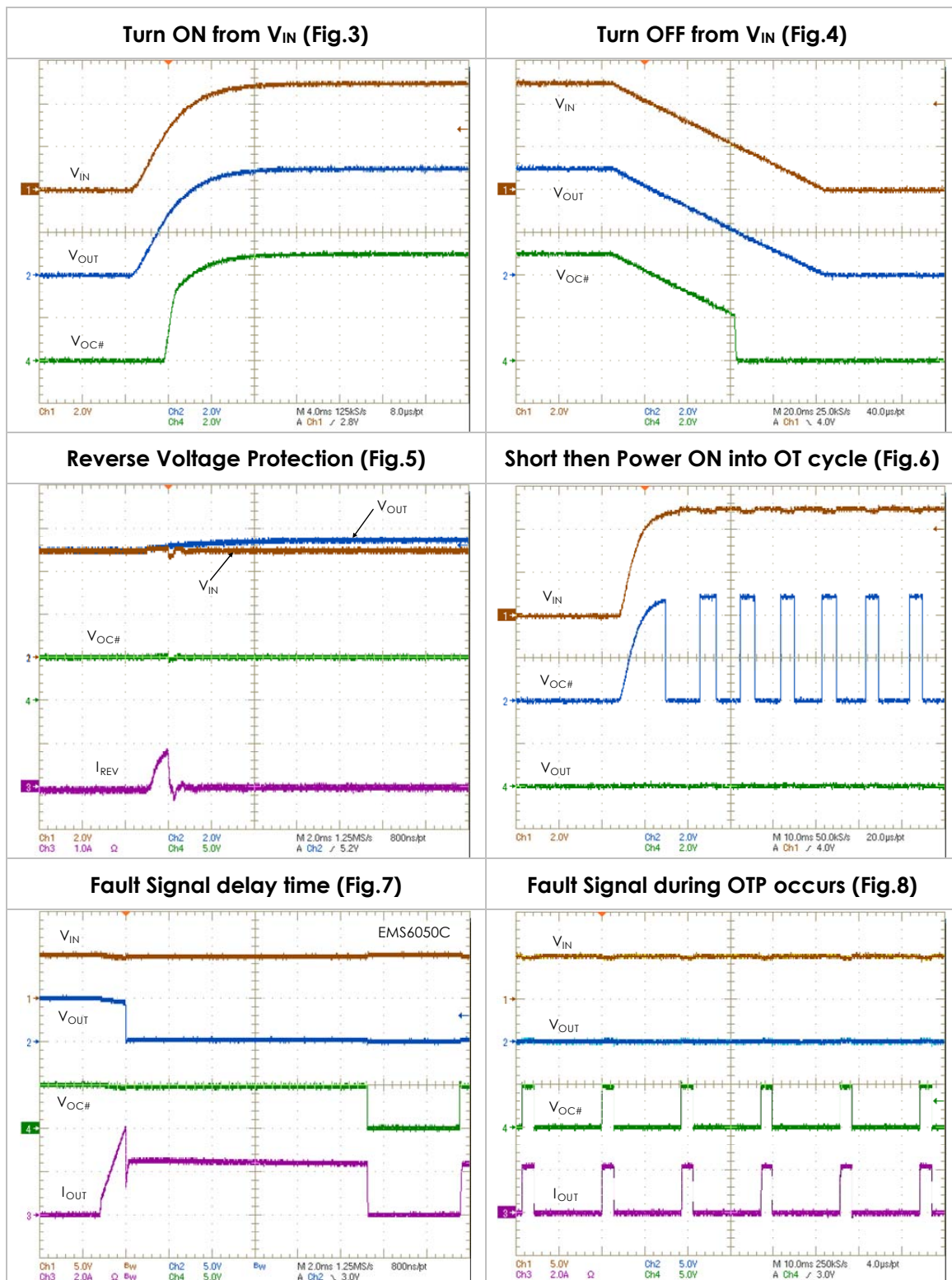
■ VIN=5V, TA=+25°C, unless otherwise specified.

Parameter	Symbol	Test Conditions	Min	Typ	Max	Units
Supply Input Section						
POR Threshold	V _{PORTH}		-	2.2	2.5	V
Quiescent Current	I _Q	I _{OUT} =0A	-	65	95	μA
Shutdown Current	I _{SD}	EN#=5V	-	0.1	1	μA
Output Voltage						
On Resistance	R _{ON}	I _{OUT} =0.5A	-	40	50	mΩ
Reverse Leakage Current	I _{Rev}	V _{OUT} =5V, V _{IN} =0V	-	0.1	2	μA
Soft-Start Time		Rising from 10% to 90% CL=1μF; R _{LOAD} =10Ω	-	1.5	-	ms
Enable						
Enable High Level	V _{EN}		1.2	-	-	V
Disable Low Level	V _{SD}		-	-	0.5	V
EN Input Current	I _{EN}		-	0.1	1	μA
OC# Flag Output						
OC# Output Resistance	R _{FLGB}	I _{SINK} =1mA	-	20	-	Ω
OC# Off Current	I _{FLGB_OFF}	V _{FLGB} =5V	-	0.1	1	μA
OC# Delay Time	T _D		8	15	22	ms
OUT Shutdown Discharge Resistance	R _{DIS}		-	100	-	Ω
Protection						
OCP Threshold Level	I _{OCP}	EMS6050A/B	3.1	3.6	4.5	A
		EMS6050C/D	3.5	4.0	4.8	A
Output Short Circuit Current	I _{SC}	EMS6050A/B	1.7	2.1	2.9	A
		EMS6050C/D	1.7	2.3	2.9	A
Thermal Shutdown Temperature	T _{SD}		-	150	-	°C
Thermal Shutdown Hysteresis	T _{SDHYS}		-	30	-	°C

- Note 1.** Stresses listed as the above "Absolute Maximum Ratings" may cause permanent damage to the device. These are for stress ratings. Functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may remain possibility to affect device reliability.
- Note 2.** θ_{JA} is measured in the natural convection at $T_A=25^{\circ}\text{C}$ on a low effective thermal conductivity test board (Single layout, 1S) of JEDEC 51-3 thermal measurement standard.
- Note 3.** Devices are ESD sensitive. Handling precaution is recommended.
- Note 4.** The device is not guaranteed to function outside its operating conditions.

Typical Performance Characteristics

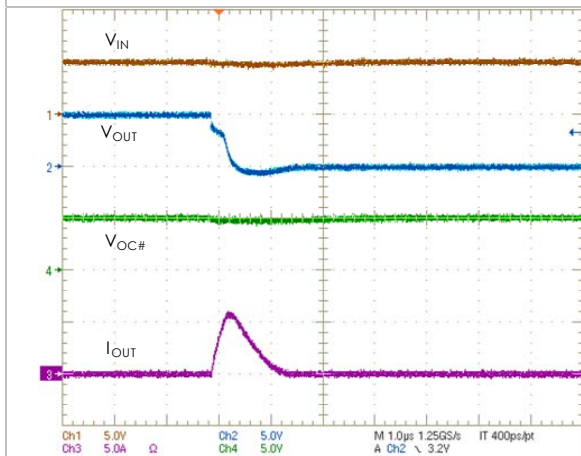
■ $V_{IN}=5V$, $T_A=25^{\circ}C$, unless otherwise specified.



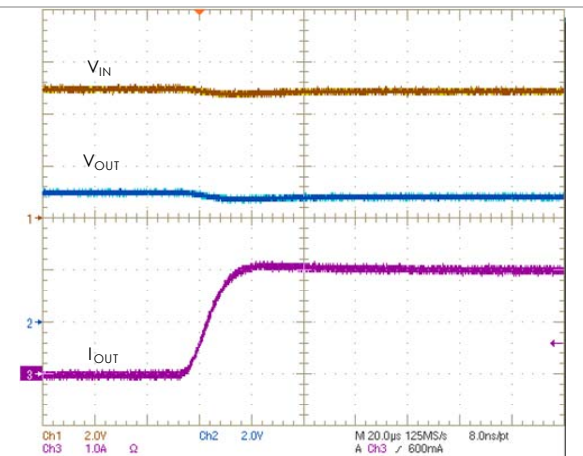
Typical Performance Characteristics (cont.)

■ $V_{IN}=5V$, $T_A=25^{\circ}C$, unless otherwise specified.

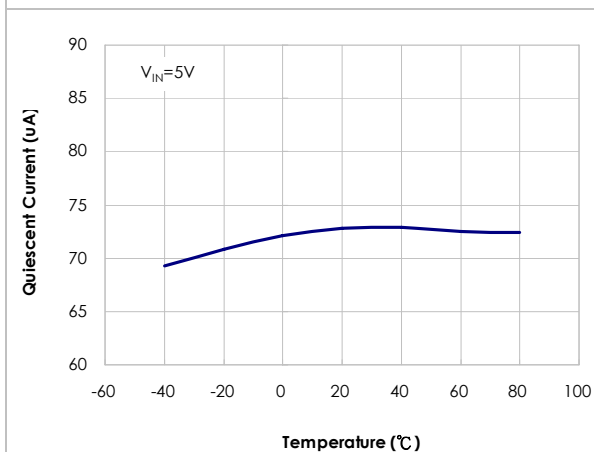
2 μs Response for output short protection (Fig.9)



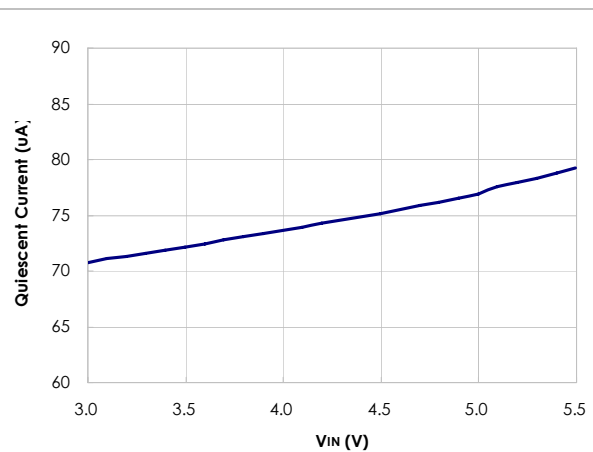
Normal operating 2A output current (Fig.10)



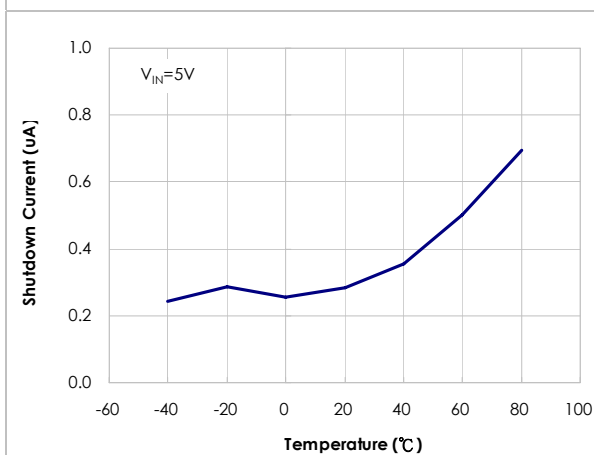
Quiescent Current vs. Temperature (Fig.11)



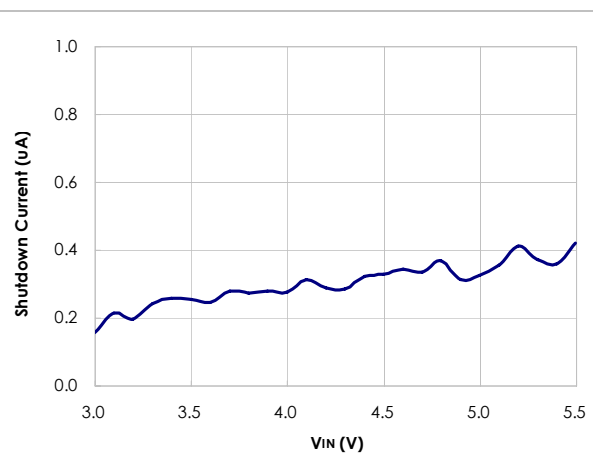
Quiescent Current vs. Input Voltage (Fig.12)



Shutdown Current vs. Temperature (Fig.13)



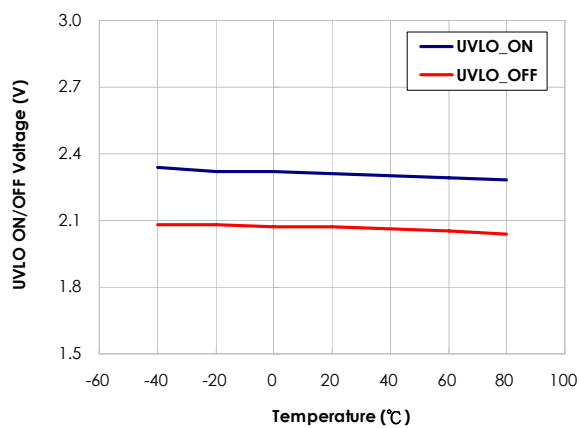
Shutdown Current vs. Input Voltage (Fig.14)



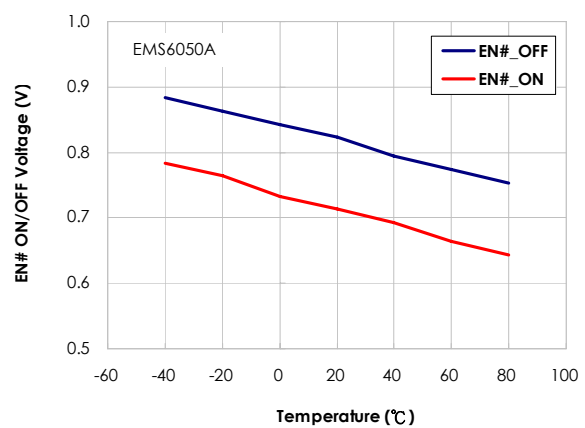
Typical Performance Characteristics (cont.)

■ $V_{IN}=5V$, $T_A=25^{\circ}C$, unless otherwise specified.

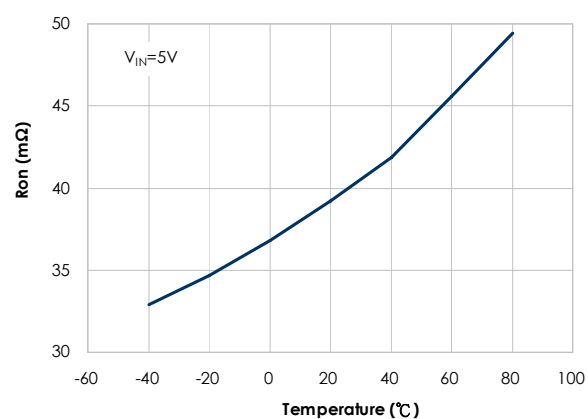
UVLO ON/OFF Voltage vs. Temperature (Fig.15)



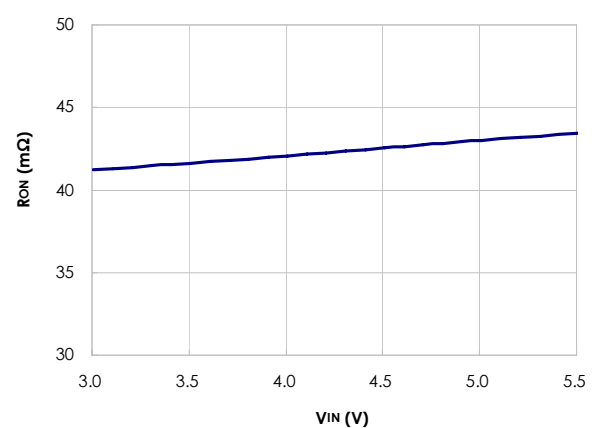
Enable Voltage vs. Temperature (Fig.16)



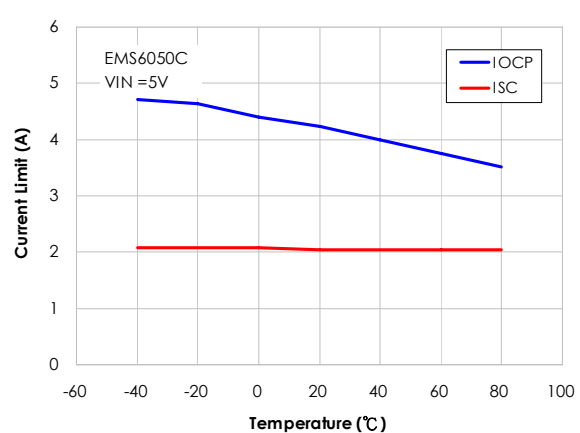
RON Performance vs. Temperature (Fig.17)



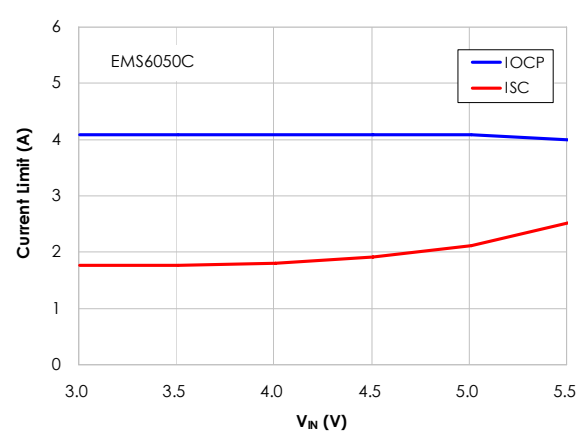
RON Performance vs. Input Voltage (Fig.18)



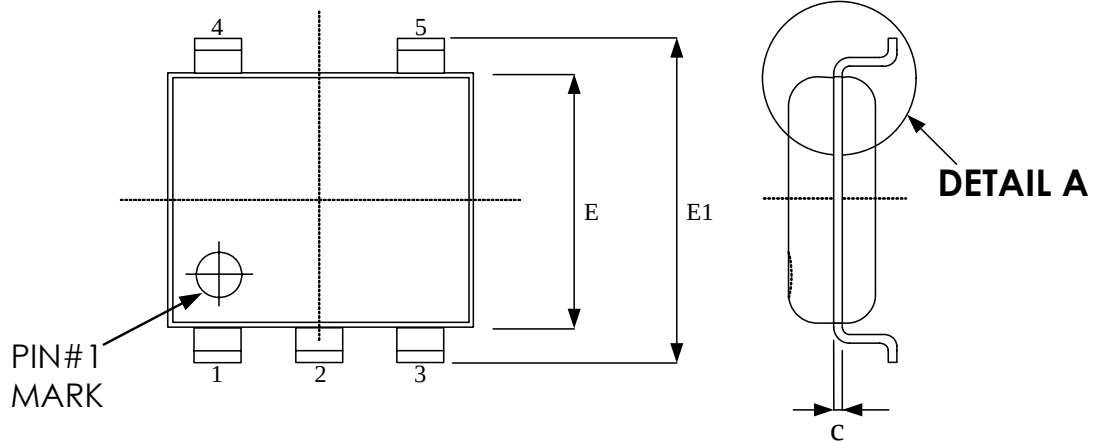
Current Limit vs. Temperature (Fig.19)



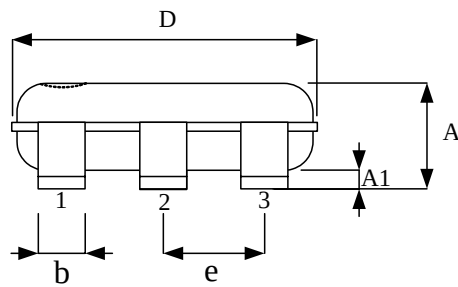
Current Limit vs. Input Voltage (Fig.20)



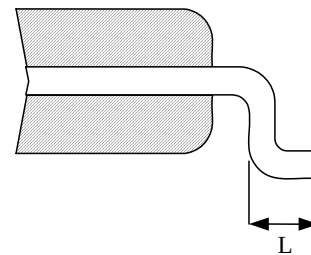
Package Outline Drawing SOT-23-5



TOP VIEW



SIDE VIEW



DETAIL A

Symbol	Dimension in mm	
	Min.	Max.
A	0.90	1.45
A1	0.00	0.15
b	0.30	0.50
c	0.08	0.25
D	2.70	3.10
E	1.40	1.80
E1	2.60	3.00
e	0.95 BSC	
L	0.30	0.60

Revision History

Revision	Date	Description
0.1	2016.06.16	Initial version.
1.0	2016.09.01	1. Remove preliminary word and modify version to 1.0 2. Modify order information

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