MIC94090/1/2/3/4/5

High Side Load Switches for Consumer Applications

Features

- 1.7V to 5.5V Input Voltage Range
- 1.2A Continuous Operating Current
- 130 mΩ $R_{DS(ON)}$
- Internal Level Shift for CMOS/TTL Control Logic
- Ultra-Low Quiescent Current
- Micro-Power Shutdown Current
- Rapid Turn-On: MIC94090/1
- Soft-Start: MIC94092/3 (790 µs), MIC94094/5 (120 µs)
- Load Discharge Circuit: MIC94091/3/5
- Space Saving and Thermally Capable 1.25 mm x 1.25 mm UDFN Package
- Industry Standard SC-70-6 Package

Applications

- Cellular Phones
- Portable Navigation Devices (PND)
- GPS Modules
- Personal Media Players (PMP)
- Ultra Mobile PCs
- Other Portable Applications
- PDAs
- Portable Instrumentation
- Industrial and DataComm Equipment

General Description

The MIC94090/1/2/3/4/5 is a family of high-side load switches designed for operation from 1.7V to 5.5V input voltage. The load switch pass element is an internal 130 mΩ $R_{DS(ON)}$ P-channel MOSFET which enables each device to support up to 1.2A continuous current. Additionally, the load switch supports 1.5V logic level control and shutdown features.

The MIC94090 and MIC94091 feature rapid turn on. The MIC94092 and MIC94093 provide a slew rate controlled soft-start turn-on of 790 µs, while the MIC94094 and MIC94095 provide a slew rate controlled soft-start turn-on of 120 µs. The soft-start feature option prevents an in-rush current event from pulling down the input supply voltage.

The MIC94091, MIC94093, and MIC94095 include a 250Ω auto discharge load circuit that is switched on when the load switch is disabled.

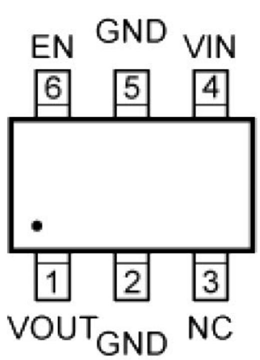
An active pull-down on the enable input keeps MIC94090/1/2/3/4/5 devices in a default OFF state until the enable pin is pulled above 1.25V. Internal level shift circuitry allows low voltage logic signals to switch higher supply voltages. The enable voltage can be as high as 5.5V and is not limited by the input voltage.

The MIC94090/1/2/3/4/5 device family's operating voltage range makes them ideal for Lithium ion as well as both NiMH, NiCad, and Alkaline battery powered systems and non-battery powered applications. The devices provide low quiescent current and low shutdown current to maximize battery life.

Package Types

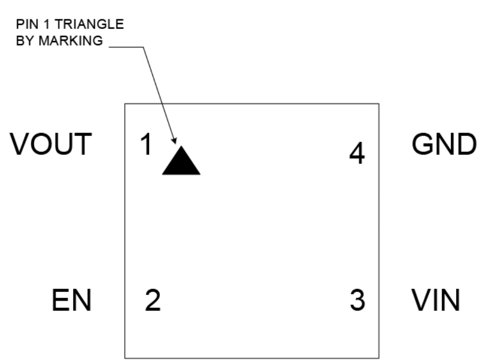
6-Lead SC-70-6 (C6)

(Top View)



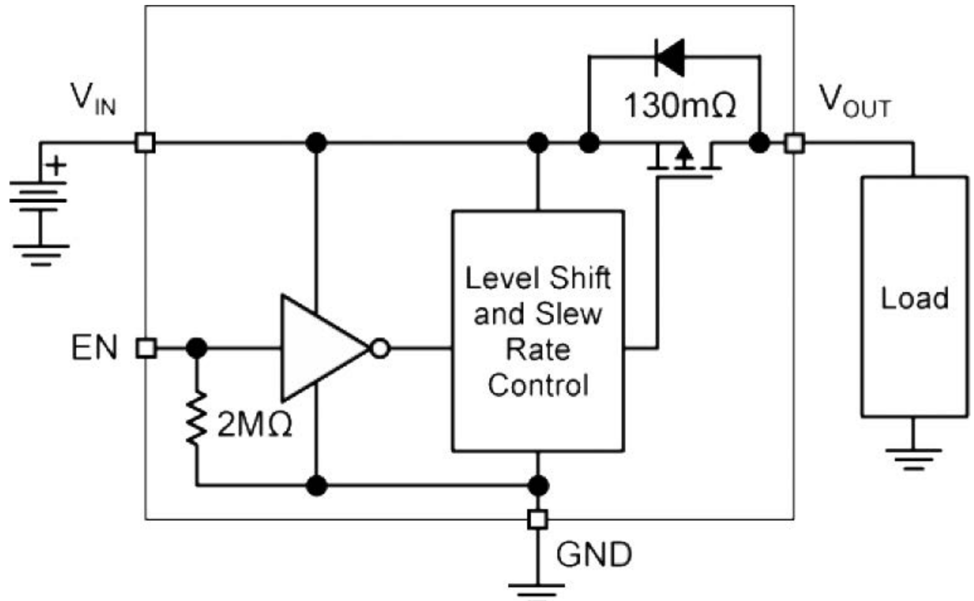
4-Lead UDFN (MT)

(Top View)

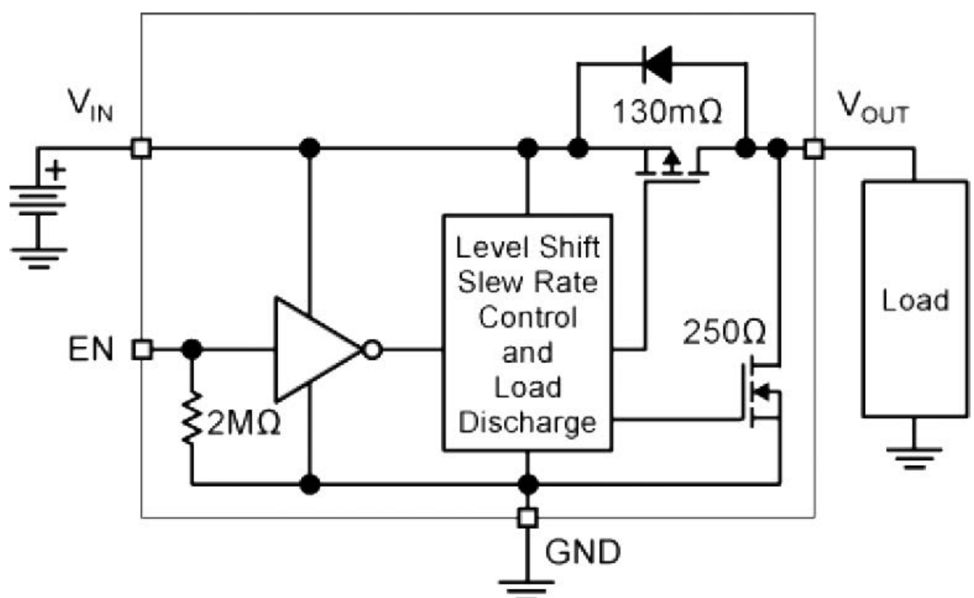


Typical Application Circuits

MIC94090 (Ultra-Fast Turn On)
MIC94092 (790 µs Soft-Start)
MIC94094 (120 µs Soft-Start)



MIC94091 (Ultra-Fast Turn On with Auto-Discharge)
MIC94093 (790 µs Soft-Start with Auto-Discharge)
MIC94095 (120 µs Soft-Start with Auto-Discharge)



1.0 ELECTRICAL CHARACTERISTICS

Absolute Maximum Ratings †

Input Voltage (V_{IN}) .... +6V
Enable Voltage (V_{EN}) .... +6V
Continuous Drain Current (I_D) (Note 1)
T_A = 25°C (UDFN) .... ±1.2A
T_A = 25°C (SC-70-6) .... ±1.2A
Pulsed Drain Current (I_{DP}) (Note 2) .... ±6.0A
Continuous Diode Current (I_S) (Note 3) .... -50 mA
ESD Rating – HBM (Note 4) .... 3 kV

Operating Ratings ‡

Input Voltage (V_{IN}) .... +1.7 to +5.5V

† Notice: Stresses above those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress rating only and functional operation of the device at those or any other conditions above those indicated in the operational sections of this specification is not intended. Exposure to maximum rating conditions for extended periods may affect device reliability.

‡ Notice: The device is not guaranteed to function outside its operating ratings.

Note 1: With backside thermal contact to PCB.

2: Pulse width < 300 µs with < 2% duty cycle.

3: Continuous body diode current conduction (reverse conduction, i.e. V_{OUT} to V_{IN}) is not recommended.

4: Devices are ESD sensitive. Handling precautions recommended. HBM (Human body model), 1.5 kΩ in series with 100 pF.

ELECTRICAL CHARACTERISTICS

T_A = 25°C, **bold** values indicate -40°C < T_A < +85°C, unless noted.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Enable Threshold Voltage	V_{EN_TH}	**0.4**	—	**1.25**	V	V_{IN} = 1.7V to 4.5V, I_D = -250 µA
Quiescent Current Measured on the V_{IN} Pin	I_Q	—	0.1	1	µA	V_{IN} = V_{EN} = 5.5V, I_D = OPEN Measured on V_{IN} MIC94090/1
		—	8	15	µA	V_{IN} = V_{EN} = 5.5V, I_D = OPEN Measured on V_{IN} MIC94092/3/4/5
Enable Input Current	I_{EN}	—	2.5	4	µA	V_{IN} = V_{EN} = 5.5V, I_D = OPEN
Shutdown Current	I_{SD}	—	0.01	1	µA	V_{IN} = +5.5V, V_{EN} = 0V, I_D = OPEN Measured on the V_{IN} pin (Note 1)
OFF State Leakage Current	$I_{SHUT\text{-}SWITCH}$	—	0.01	1	µA	V_{IN} = +5.5V, V_{EN} = 0V, I_D = SHORT, measured on V_{OUT} (Note 1)

Note 1: Measured on the MIC94090YMT.

ELECTRICAL CHARACTERISTICS (CONTINUED)

T_A = 25°C, **bold** values indicate -40°C < T_A < +85°C, unless noted.

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
P-Channel Drain to Source ON Resistance	$R_{DS(ON)}$	—	130	225	mΩ	V_{IN} = +5.0V, I_D = -100 mA, V_{EN} = 1.5V
		—	135	235	mΩ	V_{IN} = +4.5V, I_D = -100 mA, V_{EN} = 1.5V
		—	140	255	mΩ	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V
		—	170	315	mΩ	V_{IN} = +2.5V, I_D = -100 mA, V_{EN} = 1.5V
		—	235	355	mΩ	V_{IN} = +1.8V, I_D = -100 mA, V_{EN} = 1.5V
		—	260	375	mΩ	V_{IN} = +1.7V, I_D = -100 mA, V_{EN} = 1.5V
Turn-Off Resistance	$R_{SHUTDOWN}$	—	250	400	Ω	V_{IN} = +3.6V, I_{TEST} = 1 mA, V_{EN} = 0V, MIC94091/3/5
Turn-On Delay Time	t_{ON_DLY}	—	0.4	1.5	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94090/1
		200	740	1500	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94092/3
		65	110	165	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94094/5
Turn-On Rise Time	t_{ON_RISE}	—	0.4	1.5	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94090/1
		400	790	1500	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94092/3
		65	120	175	µs	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V, MIC94094/5
Turn-Off Delay Time	t_{OFF_DLY}	—	60	200	ns	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V
Turn-Off Fall Time	t_{OFF_FALL}	—	10	100	ns	V_{IN} = +3.6V, I_D = -100 mA, V_{EN} = 1.5V

Note 1: Measured on the MIC94090YMT.

TEMPERATURE SPECIFICATIONS (Note 1)

Parameters	Sym.	Min.	Typ.	Max.	Units	Conditions
Temperature Ranges						
Operating Junction Temperature Range	T_J	-40	—	+125	°C	—
Maximum Junction Temperature	$T_{J(MAX)}$	—	—	+125	°C	—
Storage Temperature	T_S	-55	—	+150	°C	—
Package Thermal Resistance						
Package Thermal Resistance, 4-Lead UDFN (Note 2)	θ_{JC}	—	60	—	°C/W	—
Package Thermal Resistance, 4-Lead UDFN (Note 2)	θ_{JA}	—	140	—	°C/W	—
Package Thermal Resistance, SC-70-6	θ_{JC}	—	100	—	°C/W	—
Package Thermal Resistance, SC-70-6	θ_{JA}	—	240	—	°C/W	—

Note 1: The maximum allowable power dissipation is a function of ambient temperature, the maximum allowable junction temperature and the thermal resistance from junction to air (i.e., T_A, T_J, θ_{JA}). Exceeding the maximum allowable power dissipation will cause the device operating junction temperature to exceed the maximum rating. Sustained junction temperatures above that maximum can impact device reliability.

2: With backside thermal contact to PCB.

2.0 TYPICAL PERFORMANCE CURVES

Note:	The graphs and tables provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some graphs or tables, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

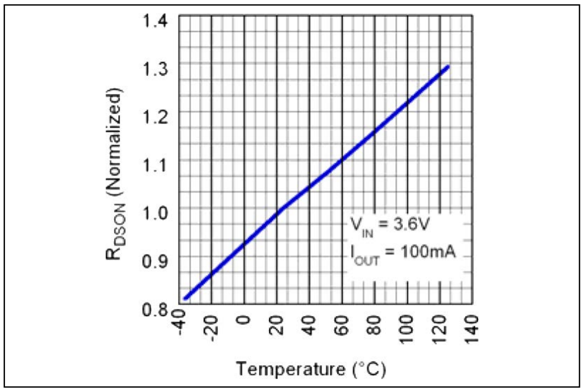


FIGURE 2-1: *R_{DSON} Variance vs. Temperature.*

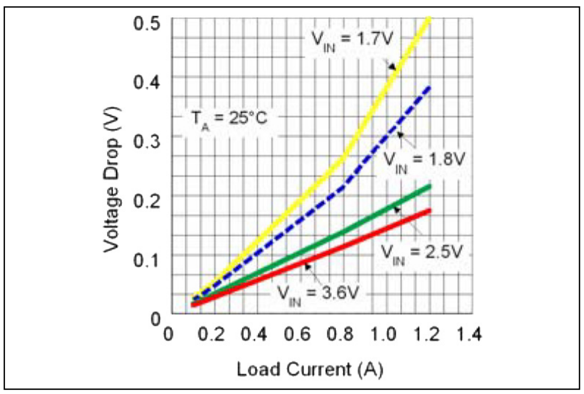


FIGURE 2-2: *Voltage Drop vs. Load Current.*

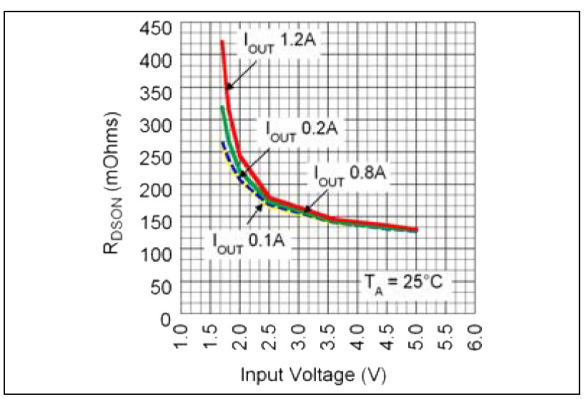


FIGURE 2-3: *On Resistance vs. Input Voltage.*

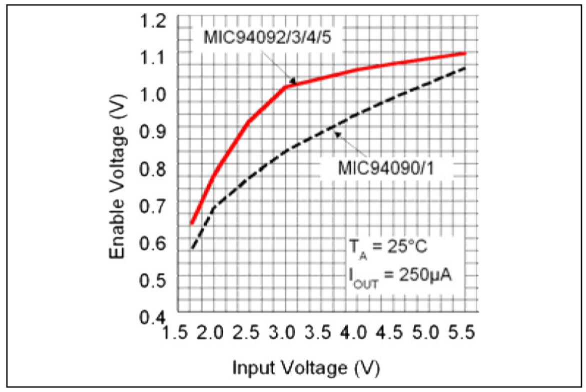


FIGURE 2-4: *Enable Threshold vs. Input Voltage.*

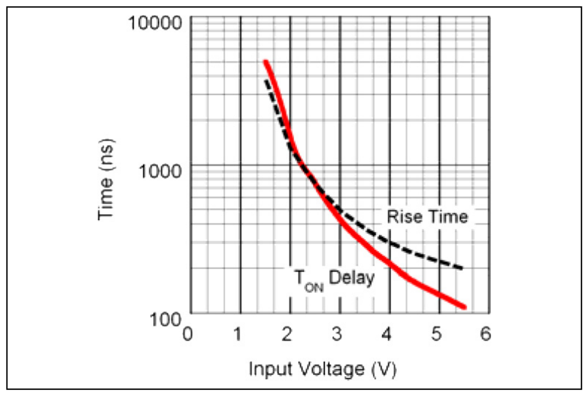


FIGURE 2-5: *MIC94090/1 t_{ON} Delay/Rise Time vs. Input Voltage.*

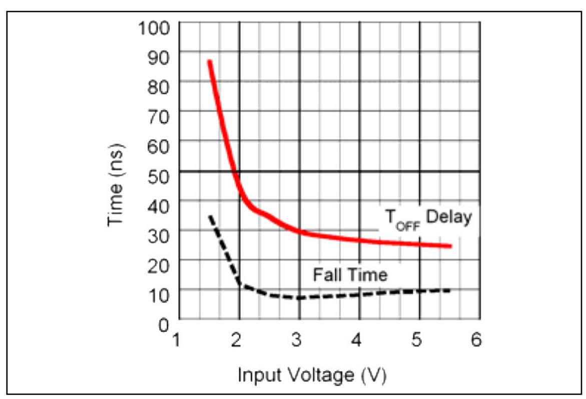


FIGURE 2-6: *MIC94090/1 t_{OFF} Delay/Fall Time vs. Input Voltage.*

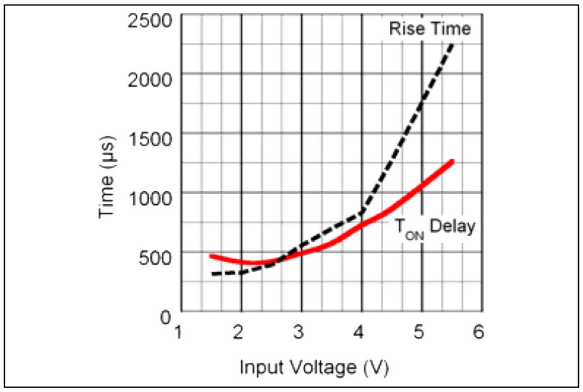


FIGURE 2-7: *MIC94092/3 t_{ON} Delay/Rise Time vs. Input Voltage.*

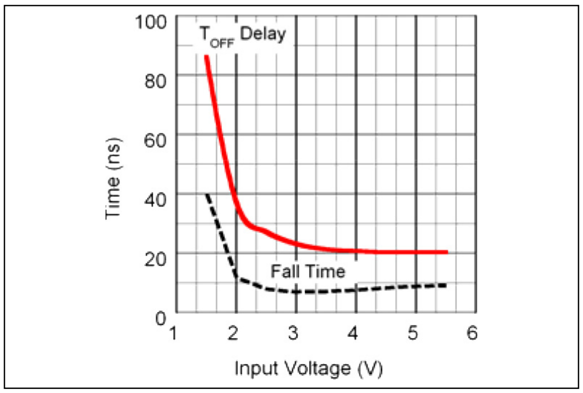


FIGURE 2-8: *MIC94092/3 t_{OFF} Delay/Fall Time vs. Input Voltage.*

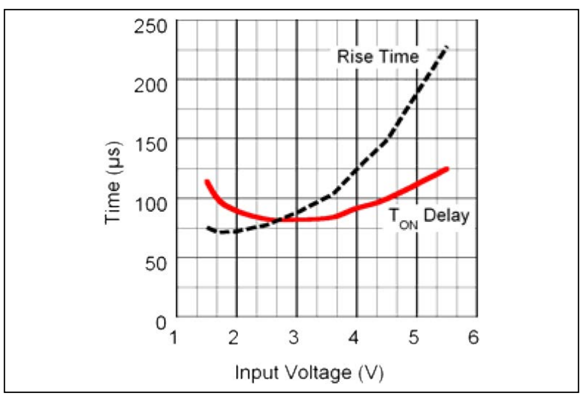


FIGURE 2-9: *MIC94094/5 t_{ON} Delay/Rise TIme vs. Input Voltage.*

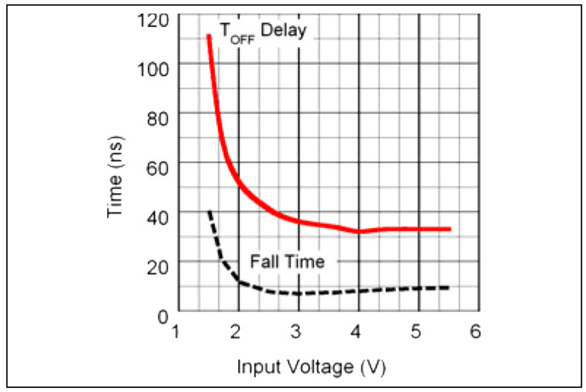


FIGURE 2-10: *MIC94094/5 t_{OFF} Delay/Fall Time vs. Input Voltage.*

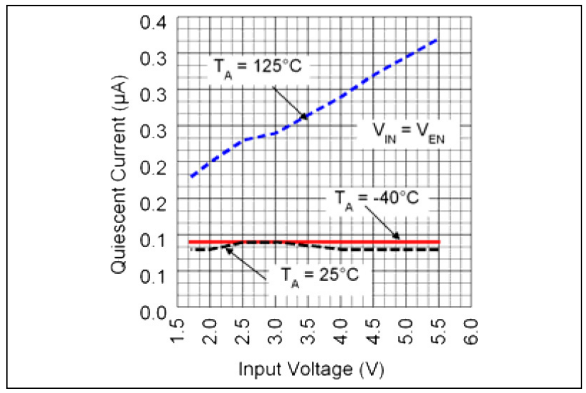


FIGURE 2-11: *MIC94090/1 Quiescent Current vs. Input Voltage.*

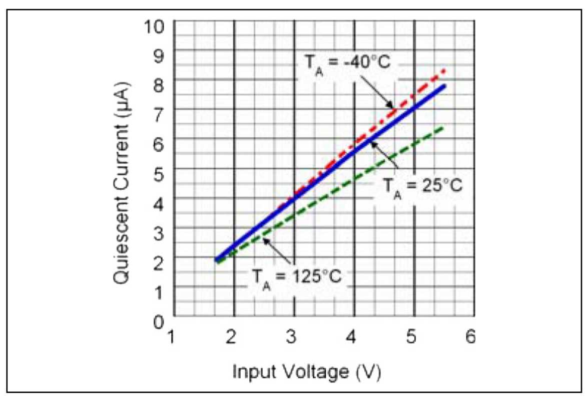


FIGURE 2-12: *MIC94092/3/4/5 Quiescent Current vs. Input Voltage.*

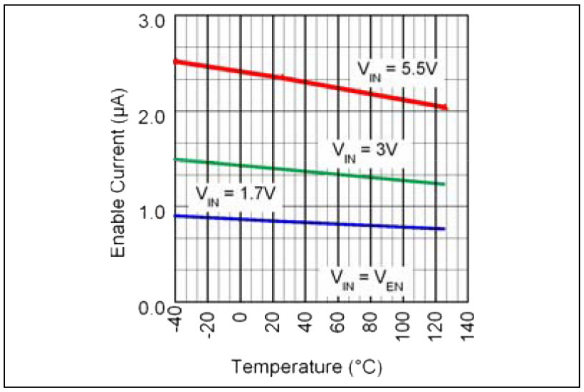


FIGURE 2-13: *MIC94090/1/2/3/4/5 Enable Current vs. Temperature.*

3.0 FUNCTIONAL CHARACTERISTICS

Note: The scopes provided following this note are a statistical summary based on a limited number of samples and are provided for informational purposes only. The performance characteristics listed herein are not tested or guaranteed. In some scopes, the data presented may be outside the specified operating range (e.g., outside specified power supply range) and therefore outside the warranted range.

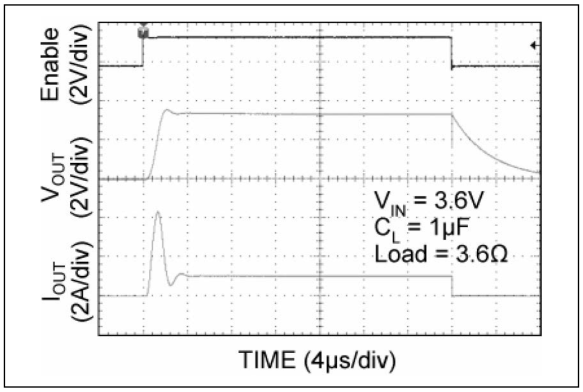


FIGURE 3-1: *MIC94090.*

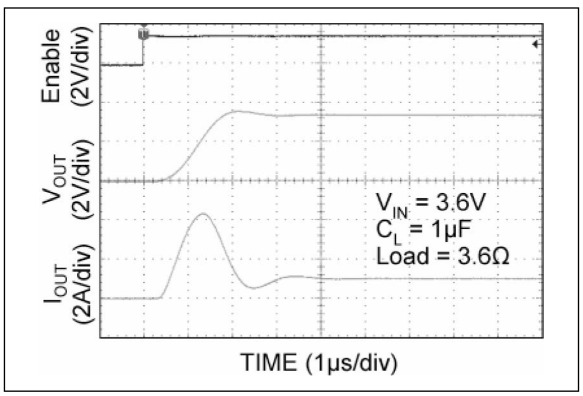


FIGURE 3-2: *MIC94090.*

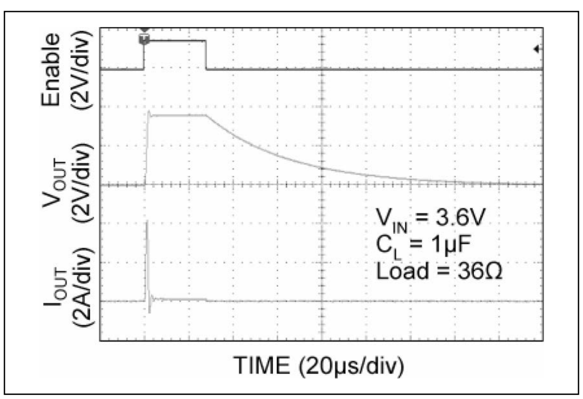


FIGURE 3-3: *MIC94090.*

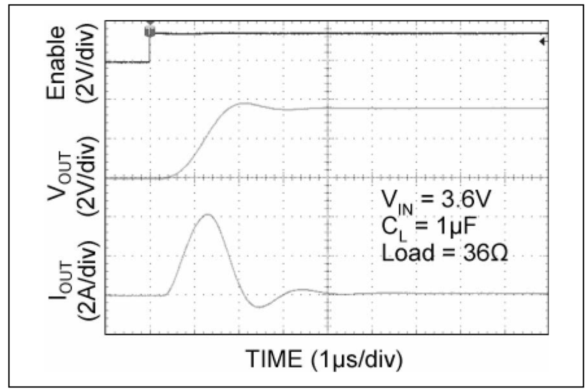


FIGURE 3-4: *MIC94090.*

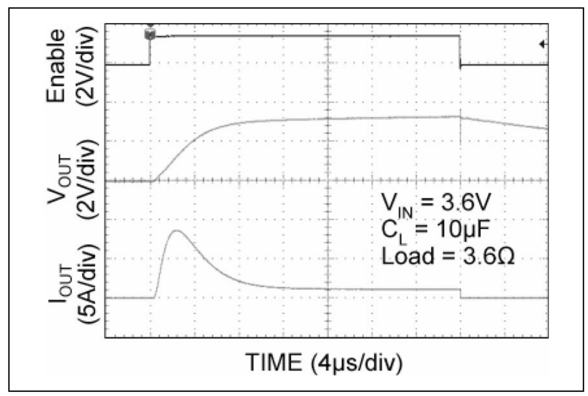


FIGURE 3-5: *MIC94090.*

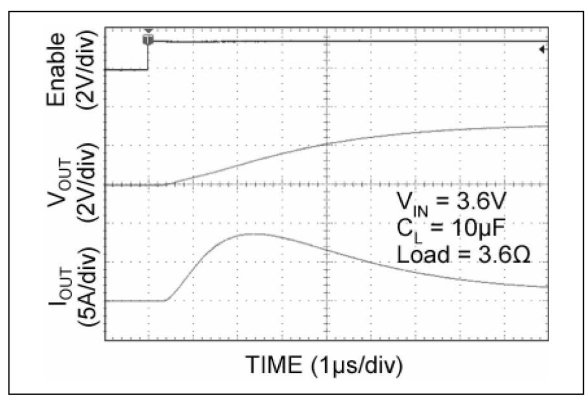


FIGURE 3-6: *MIC94090.*

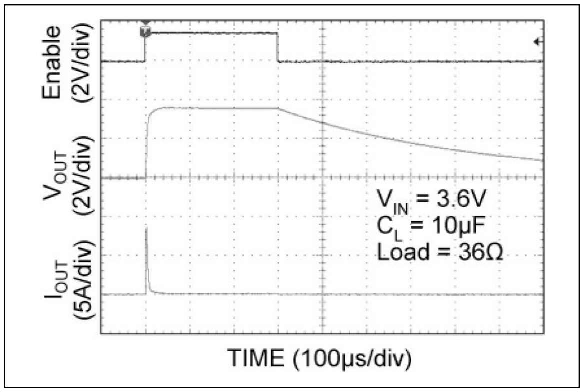


FIGURE 3-7: *MIC94090.*

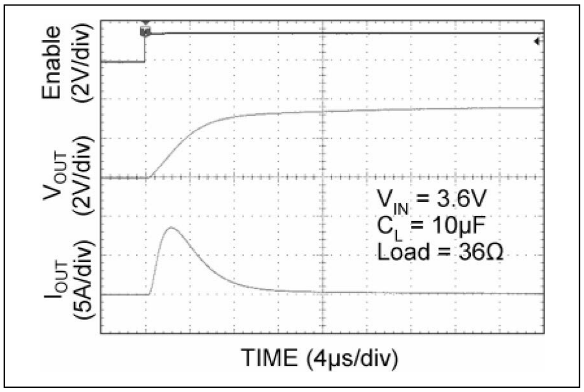


FIGURE 3-8: *MIC94090.*

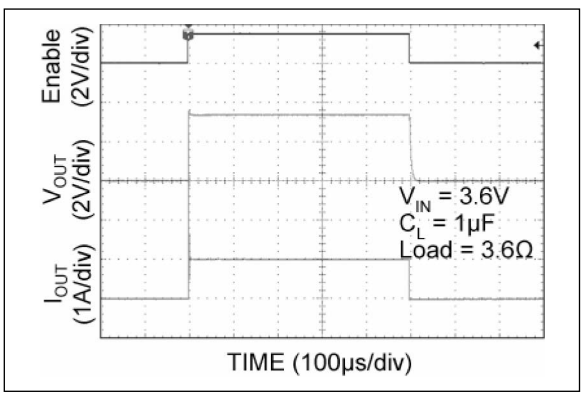


FIGURE 3-9: *MIC94091.*

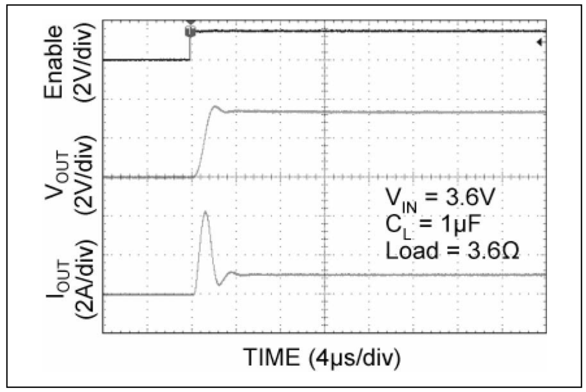


FIGURE 3-10: *MIC94091.*

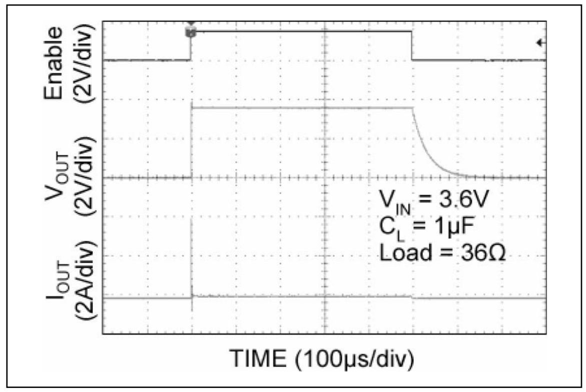


FIGURE 3-11: *MIC94091.*

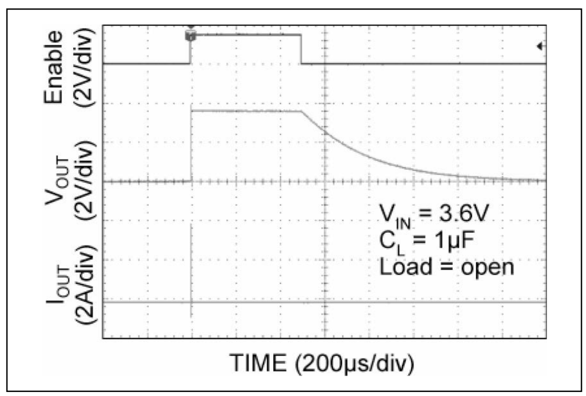


FIGURE 3-12: *MIC94091.*

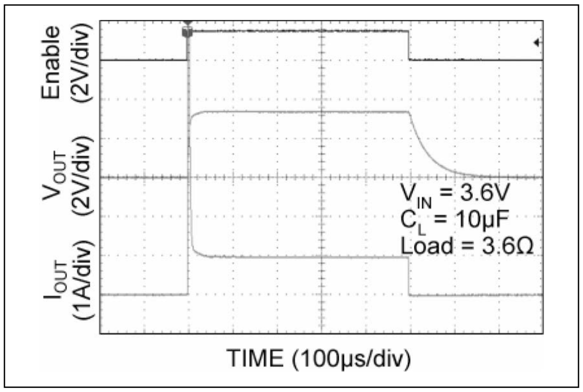


FIGURE 3-13: *MIC94091.*

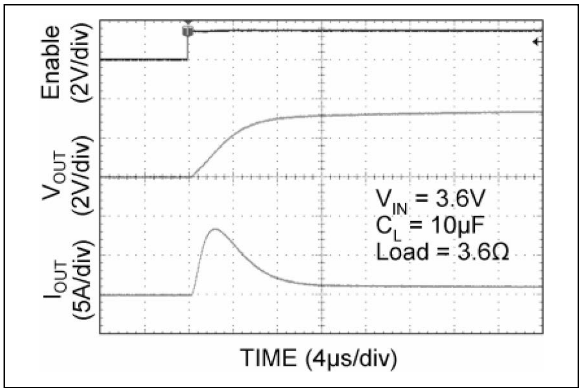


FIGURE 3-14: *MIC94091.*

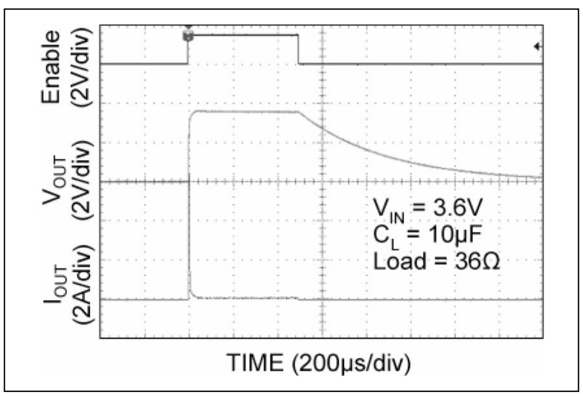


FIGURE 3-15: *MIC94091.*

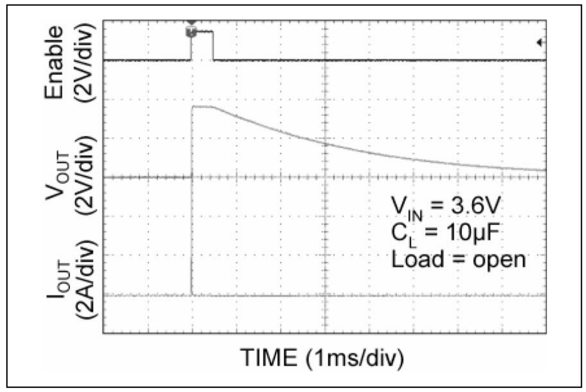


FIGURE 3-16: *MIC94091.*

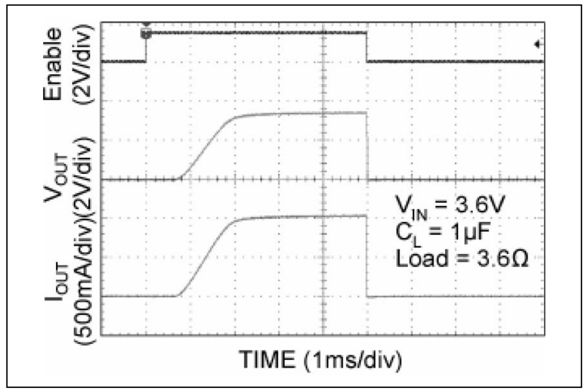


FIGURE 3-17: *MIC94092.*

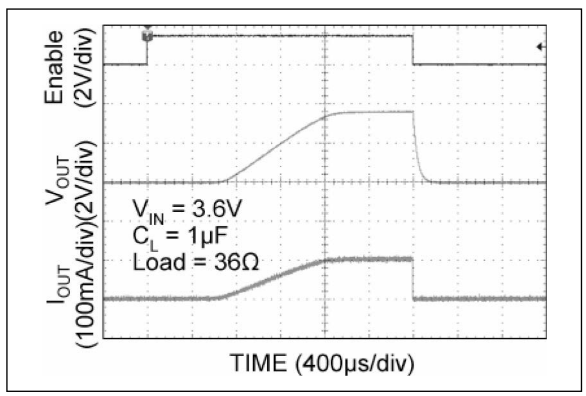


FIGURE 3-18: *MIC94092.*

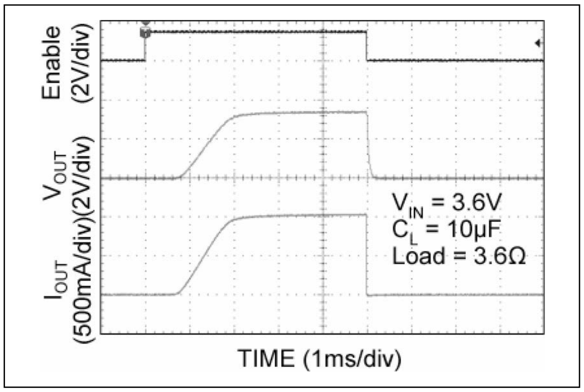


FIGURE 3-19: MIC94092.

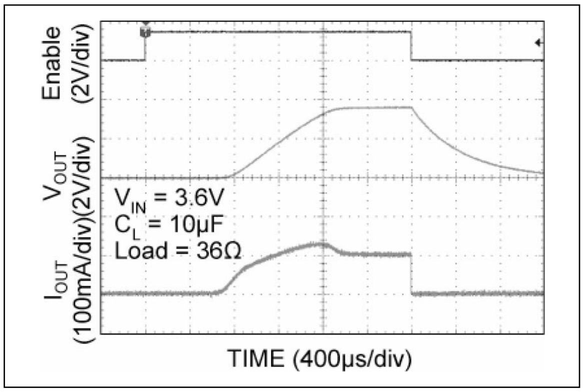


FIGURE 3-20: MIC94092.

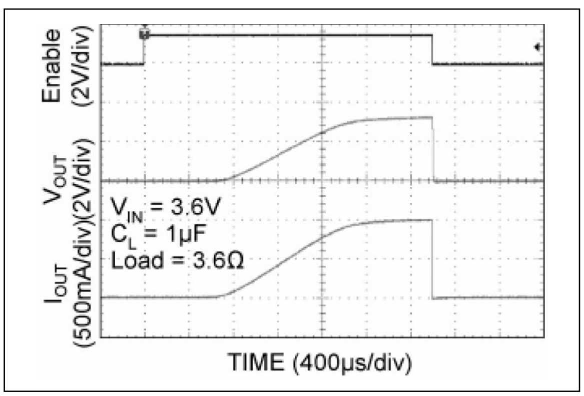


FIGURE 3-21: MIC94093.

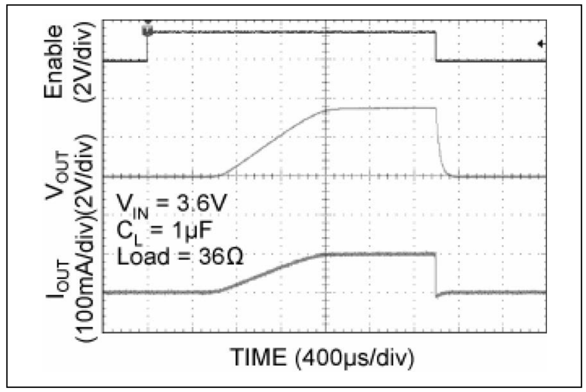


FIGURE 3-22: MIC94093.

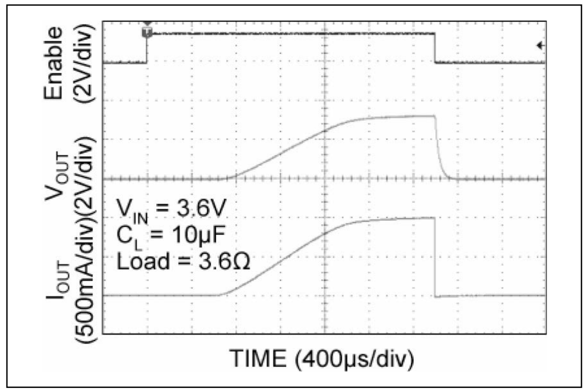


FIGURE 3-23: MIC94093.

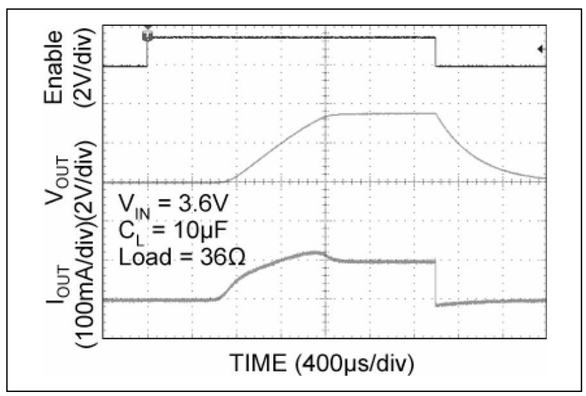


FIGURE 3-24: MIC94093.

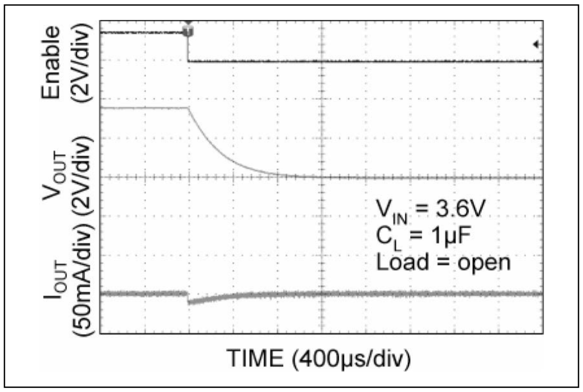


FIGURE 3-25: *MIC94093.*

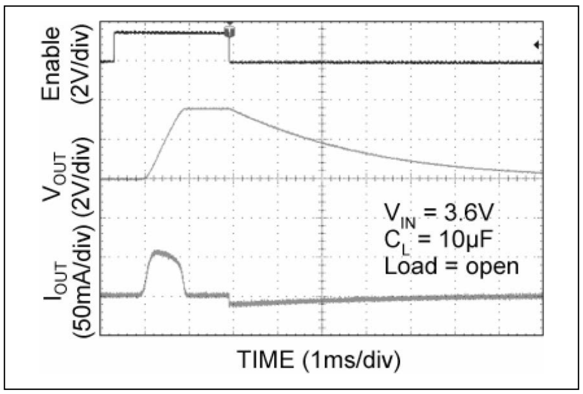


FIGURE 3-26: *MIC94093.*

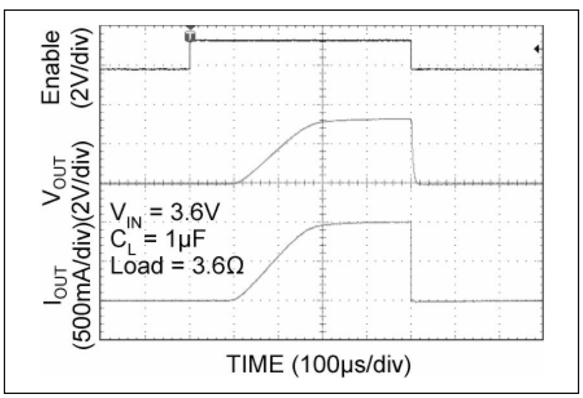


FIGURE 3-27: *MIC94094.*

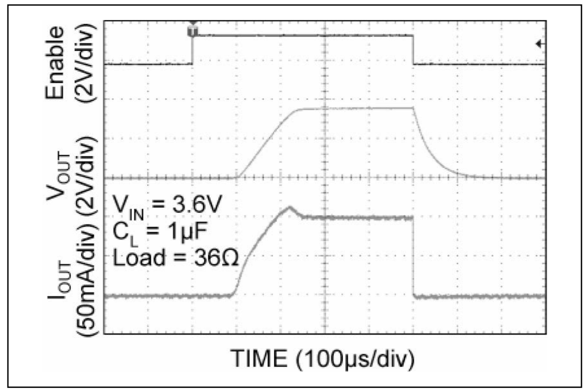


FIGURE 3-28: *MIC94094.*

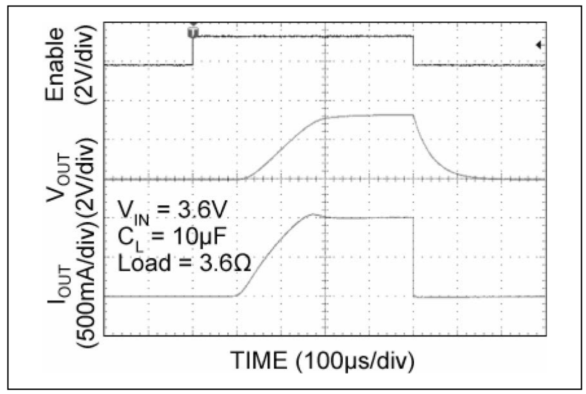


FIGURE 3-29: *MIC94094.*

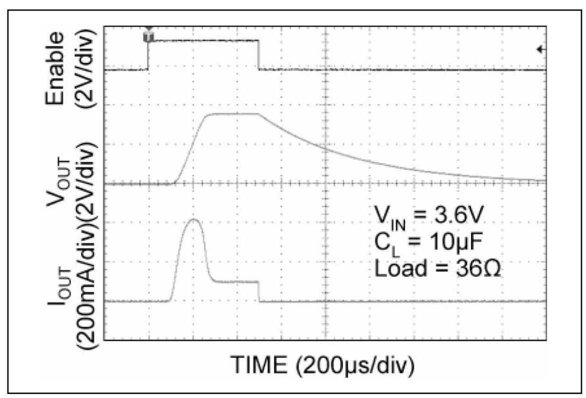


FIGURE 3-30: *MIC94094.*

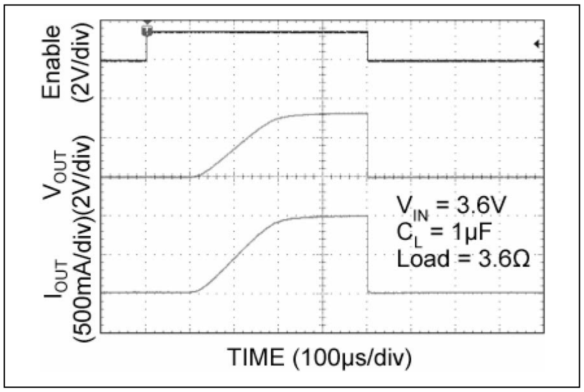


FIGURE 3-31: *MIC94095.*

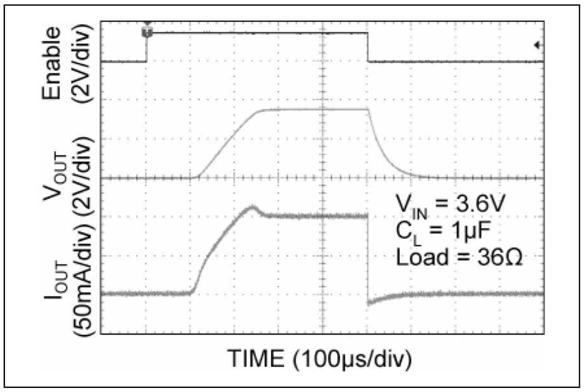


FIGURE 3-32: *MIC94095.*

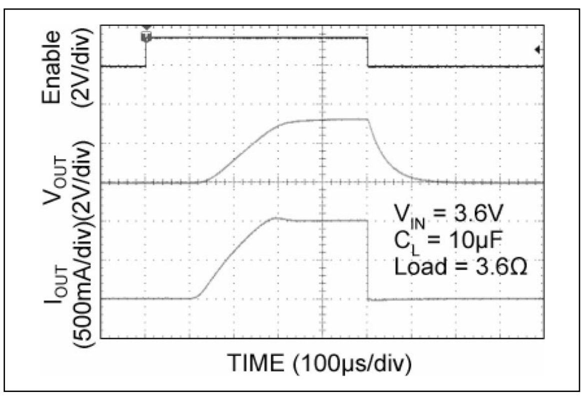


FIGURE 3-33: *MIC94095.*

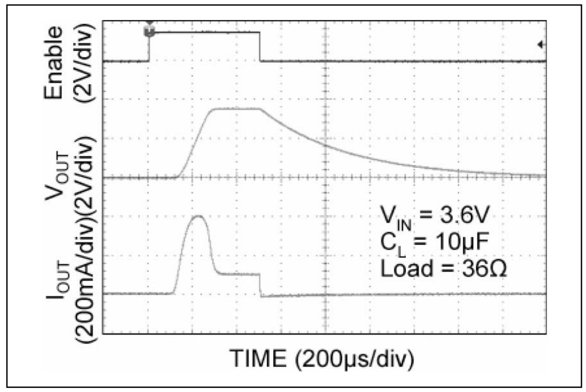


FIGURE 3-34: *MIC94095.*

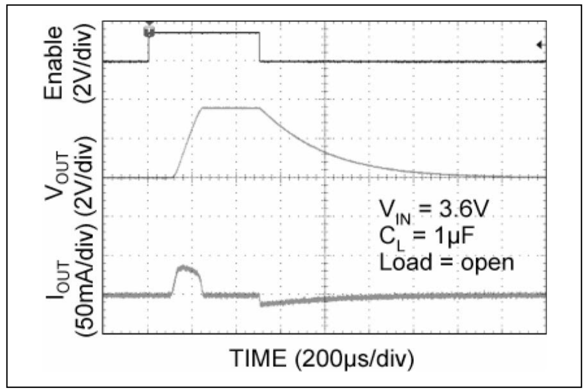


FIGURE 3-35: *MIC94095.*

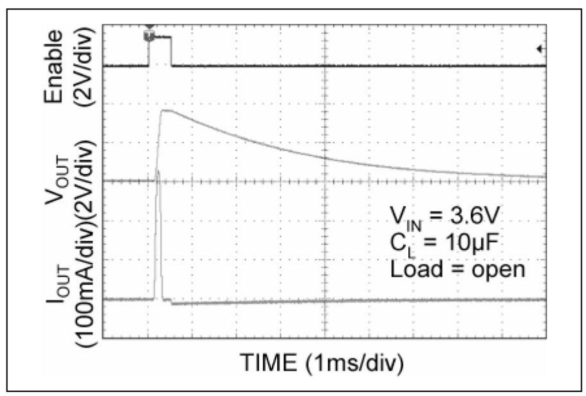


FIGURE 3-36: *MIC94095.*

4.0 PIN DESCRIPTIONS

The descriptions of the pins are listed in Table 4-1.

TABLE 4-1: PIN FUNCTION TABLE

Pin Number		Pin Name	Pin Function
UDFN	SC-70-6		
1	1	VOUT	Drain of P-Channel MOSFET.
4	2, 5	GND	Ground: Connect to electrical ground.
3	4	VIN	Source of P-Channel MOSFET.
2	6	EN	Enable (Input): Active-high CMOS-compatible control input for switch. Internal 2 MΩ pull down resistor to GND, output will be off if this pin is left floating.
—	3	NC	No Internal Connection. A signal or voltage applied to this pin will have no effect on device operation.

5.0 APPLICATION INFORMATION

5.1 Power Dissipation Considerations

As with all power switches, the ultimate current rating of the switch is limited by the thermal properties of the package and the PCB it is mounted on. There is a simple, ohms law type relationship between thermal resistance, power dissipation and temperature which are analogous to an electrical circuit:

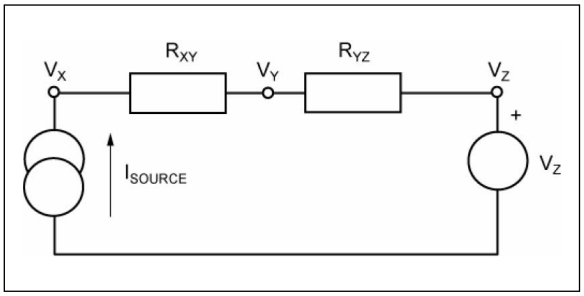


FIGURE 5-1: *Electrical Circuit.*

From this simple circuit we can calculate Vx if we know I_{SOURCE}, Vz and the resistor values, Rxy and Ryz using the equation:

EQUATION 5-1:

$$Vx = I_{SOURCE} \times (Rxy + Ryz) + Vz$$

Thermal circuits can be considered using these same rules and can be drawn similarly replacing current sources with Power dissipation (in Watts), Resistance with Thermal Resistance (in °C/W) and Voltage sources with temperature (in °C).

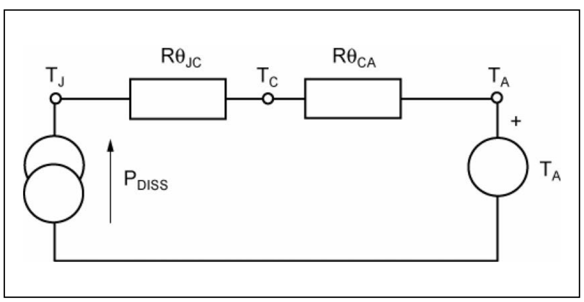


FIGURE 5-2: *Thermal Equivalent Circuit.*

Now replacing the variables in the equation for Vx, we can find the junction temperature (T_J) from power dissipation, ambient temperature and the known thermal resistance of the PCB ($R_{\theta CA}$) and the package ($R_{\theta JA}$).

EQUATION 5-2:

$$T_J = P_{DISS} \times (R_{\theta JC} + R_{\theta CA}) + T_{AMB}$$

It is this equation that is used to determine the graphs in Section 2.0, Typical Performance Curves. P_{DISS} is calculated as (I_{SWITCH}^2 x R_{SWmax}). $R_{\theta JC}$ is found in the operating ratings section of the data sheet and $R_{\theta CA}$ (the PCB thermal resistance) values for various PCB copper areas can be taken from Designing with Low Dropout Voltage Regulators, available on the Microchip website.

EXAMPLE 5-1:

A switch is intended to drive a 500 mA load and is placed on a printed circuit board which has a ground plane area of at least 25 mm square. The Voltage source is a Li-ion battery with a lower operating threshold of 3V and the ambient temperature of the assembly can be up to 50°C.

Summary of variables:

- I_{SW} = 0.5A
- V_{IN} = 3V to 4.2V
- T_{AMB} = 50°C
- $R_{\theta JC}$ = 60°C/W
- $R_{\theta CA}$ = 53°C/W, read from Figure 5-3.

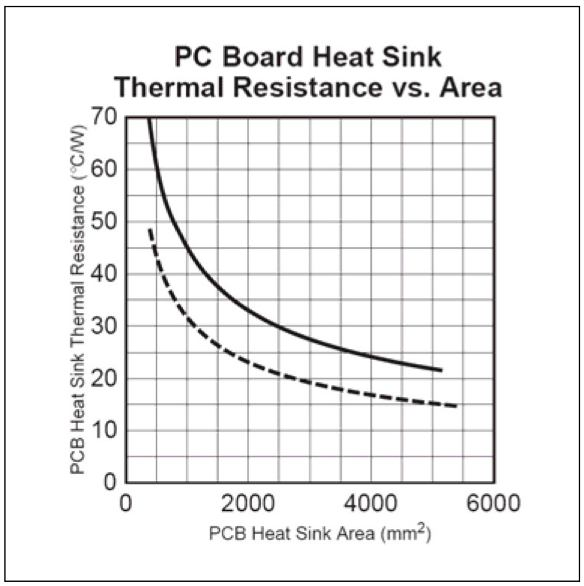


FIGURE 5-3: *Electrical Circuit.*

EQUATION 5-3:

$$P_{DISS} = I_{SW}^2 \times R_{SWmax}$$

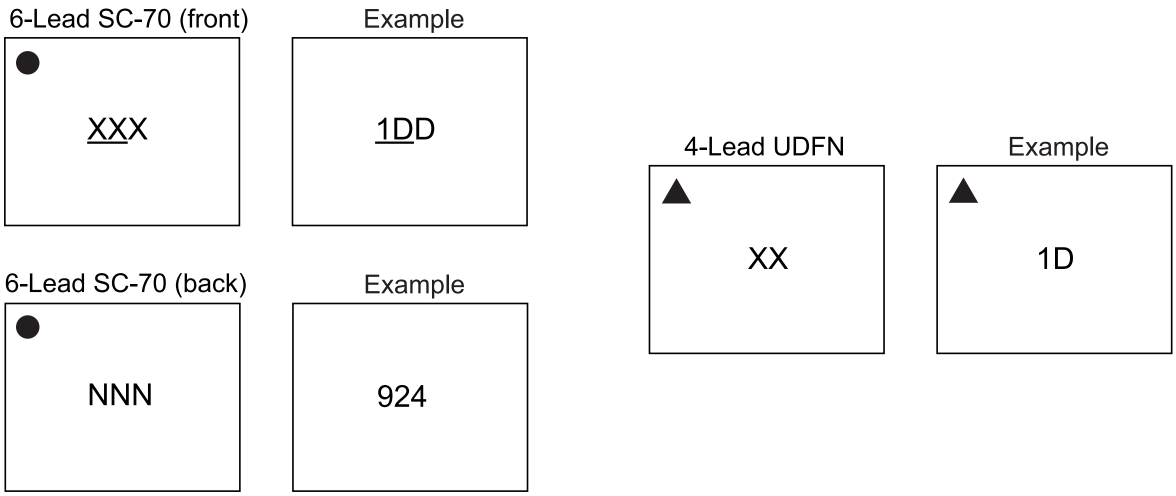
The worst case switch resistance (R_{SWmax}) at the lowest V_{IN} of 3V is not available in the data sheet, so the next lower value of V_{IN} is used: R_{SWmax} at 2.5V = 315 mΩ.

If this were a figure for worst case R_{SWmax} for 25°C, an additional consideration is to allow for the maximum junction temperature of 125°C, the actual worst case resistance in this case will be 30% higher (see $R_{DS(ON)}$ variance vs. temperature graph):
R_{SWmax} at 2.5V (at 125°C) = 315 x 1.3 = 410 mΩ.

Therefore, junction temperature (T_J):
T_J = 0.52 x 0.41 x (60+53) + 50 (from Equation 5-2) and
T_J = 62°C. This is well below the maximum 125°C.

6.0 PACKAGING INFORMATION

6.1 Package Marking Information



Legend:	XX...X	Product code or customer-specific information
	Y	Year code (last digit of calendar year)
	YY	Year code (last 2 digits of calendar year)
	WW	Week code (week of January 1 is week ‘01’)
	NNN	Alphanumeric traceability code
	(e3)	Pb-free JEDEC® designator for Matte Tin (Sn)
	*	This package is Pb-free. The Pb-free JEDEC designator ((e3)) can be found on the outer packaging for this package.
	●, ▲, ▼	Pin one index is identified by a dot, delta up, or delta down (triangle mark).

Note: In the event the full Microchip part number cannot be marked on one line, it will be carried over to the next line, thus limiting the number of available characters for customer-specific information. Package may or may not include the corporate logo.

Underbar (_) and/or Overbar (‾) symbol may not be to scale.

Note: If the full seven-character YYWWNNN code cannot fit on the package, the following truncated codes are used based on the available marking space:
6 Characters = YWWNNN; 5 Characters = WWNNN; 4 Characters = WNNN; 3 Characters = NNN;
2 Characters = NN; 1 Character = N.

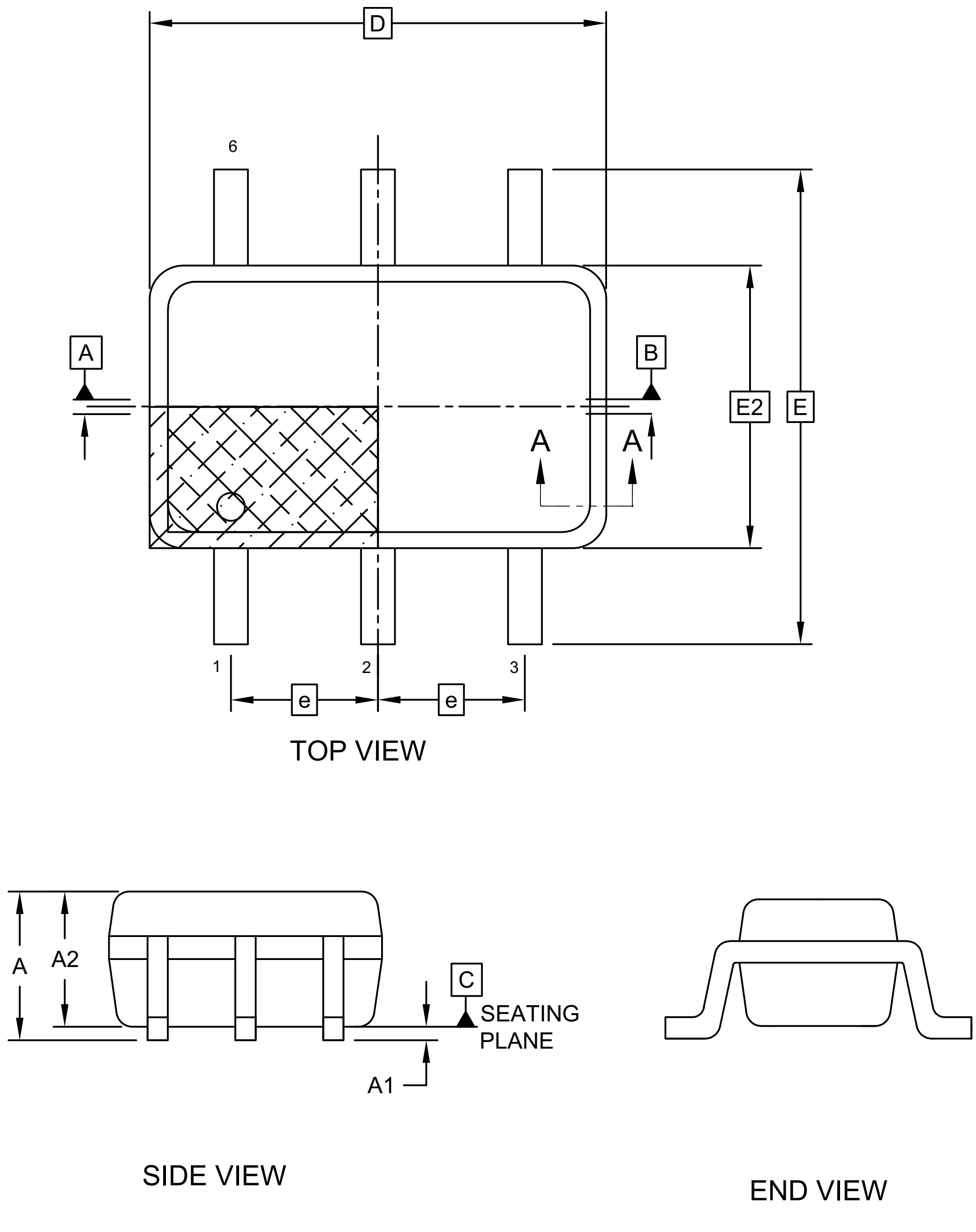
TABLE 6-1: MARKING CODES

Part Number	Part Marking (Note 1)	Fast Turn On	Soft-Start	Load Discharge	Package (Note 2) (Note 3)
MIC94090YC6	D1D	Yes	—	No	6-Lead SC-70
MIC94091YC6	D2D	Yes	—	Yes	6-Lead SC-70
MIC94092YC6	D5D	No	790 µs	No	6-Lead SC-70
MIC94093YC6	D7D	No	790 µs	Yes	6-Lead SC-70
MIC94094YC6	0DD	No	120 µs	No	6-Lead SC-70
MIC94095YC6	1DD	No	120 µs	Yes	6-Lead SC-70
MIC94090YMT	D1	Yes	—	No	4-Lead 1.25 mm x 1.25 mm UDFN
MIC94091YMT	D2	Yes	—	Yes	4-Lead 1.25 mm x 1.25 mm UDFN
MIC94092YMT	D5	No	790 µs	No	4-Lead 1.25 mm x 1.25 mm UDFN
MIC94093YMT	D7	No	790 µs	Yes	4-Lead 1.25 mm x 1.25 mm UDFN
MIC94094YMT	0D	No	120 µs	No	4-Lead 1.25 mm x 1.25 mm UDFN
MIC94095YMT	1D	No	120 µs	Yes	4-Lead 1.25 mm x 1.25 mm UDFN

Note 1: Under bar symbol (__) may not be to scale.
2: UDFN ▲ = Pin 1 identifier.
3: UDFN is a GREEN RoHS-compliant package. Lead finish is NiPdAu. Mold compound is Halogen Free.

6-Lead Plastic package, EIAJ standard (D4A) - 2.0x1.25 mm Body [SC70]
Micrel Legacy Package

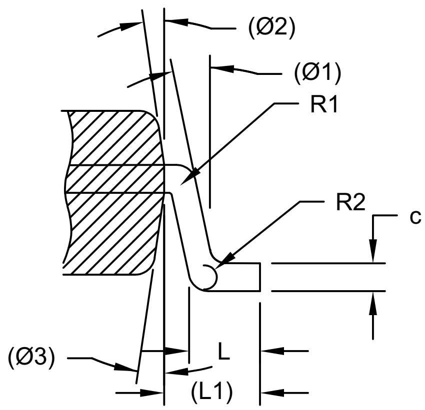
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



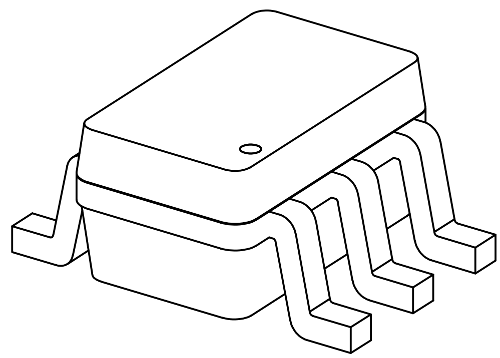
Microchip Technology Drawing C04-1133 Rev A Sheet 1 of 2

6-Lead Plastic package, EIAJ standard (D4A) - 2.0x1.25 mm Body [SC70] Micrel Legacy Package

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



SECTION A–A



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		6	
Pitch	e		0.65 BSC	
Overall Height	A	-	-	1.10
Standoff	A1	0.00	-	0.10
Molded Package Thickness	A2	0.80	–	1.00
Overall Length	D		2.00 BSC	
Overall Width	E		2.10 BSC	
Molded Package Width	E2		1.25 BSC	
Terminal Width	b	0.15	–	0.30
Terminal Thickness	c	0.08	-	0.25
Terminal Length	L	0.21	–	0.46
Footprint	L1		0.55 REF	
Lead Bend Radius	R1	0.02	-	0.08
Lead Bend Radius	R2	0.08	-	0.20
Lead Angle	θ1		12° REF	
Mold Draft Angle	θ2		8° REF	
Mold Draft Angle	θ3		8° REF	

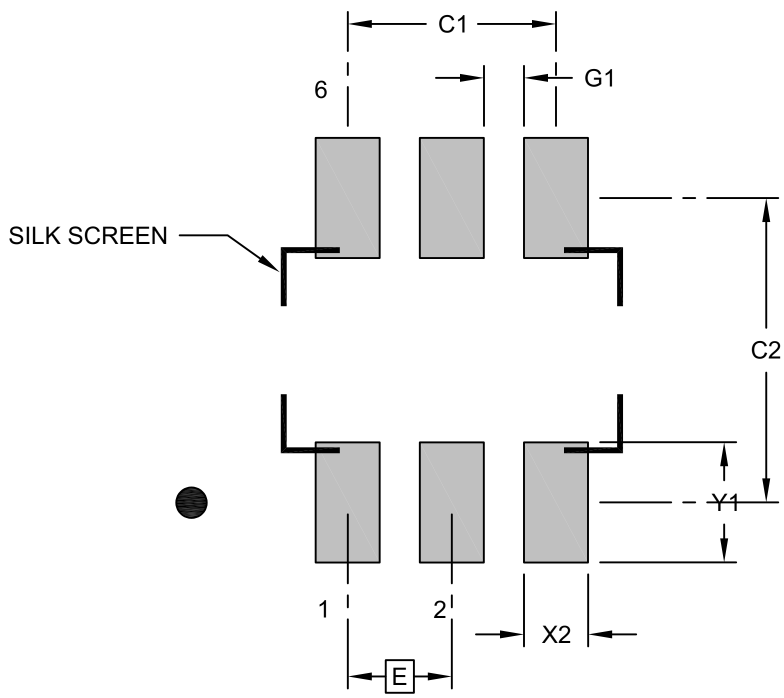
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1133 Rev A Sheet 2 of 2

6-Lead Plastic package, EIAJ standard (D4A) - 2.0x1.25 mm Body [SC70] Micrel Legacy Package

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Contact Pad Spacing	C1		1.30	
Contact Pad Spacing	C2		1.90	
Contact Pad Width (X6)	X1			0.42
Contact Pad Length (X6)	Y1			0.77
Contact Pad to Contact Pad (X4)	G1	0.25		

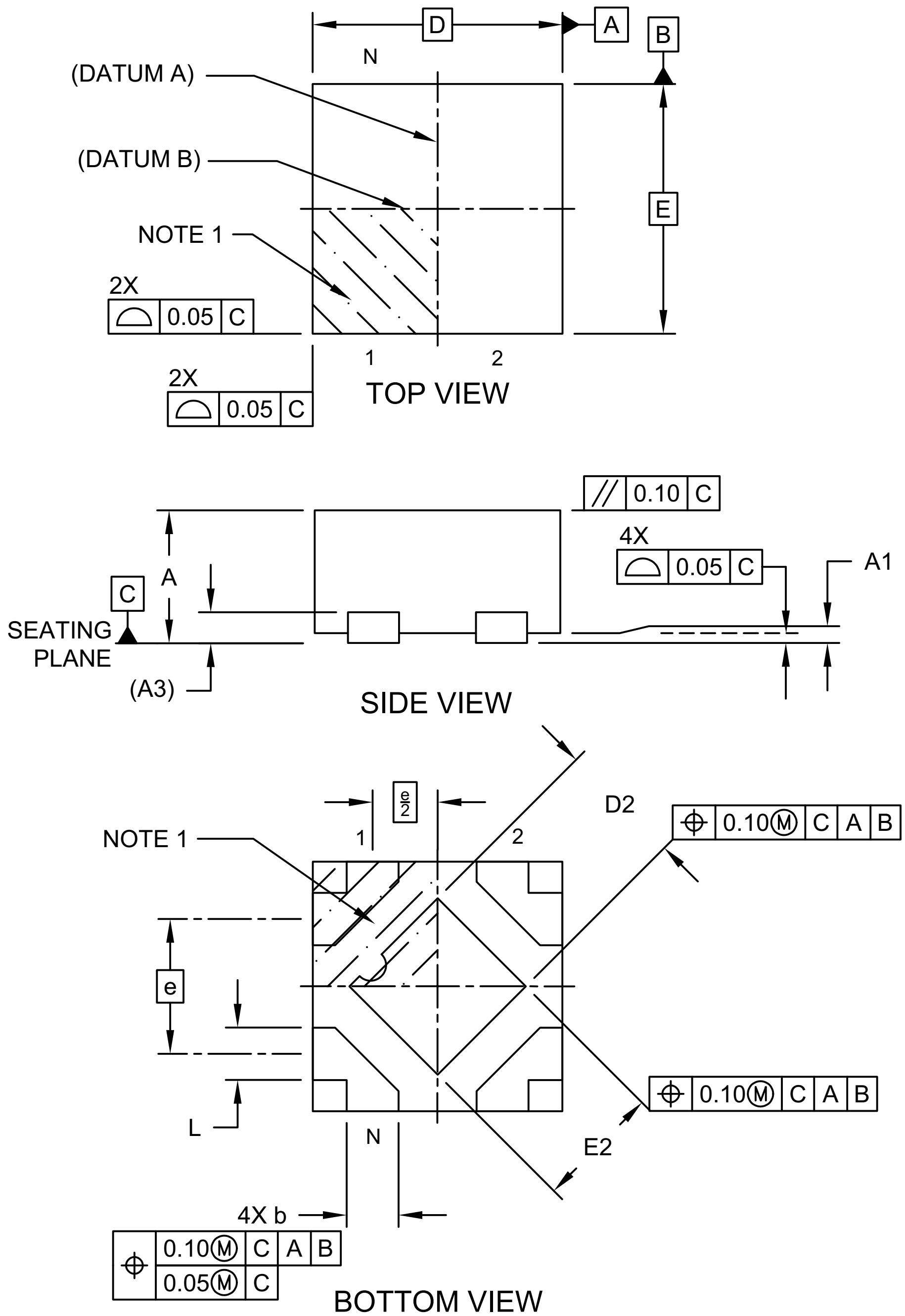
Notes:

1. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
2. For best soldering results, thermal vias, if used, should be filled or tented to avoid solder loss during reflow process

Microchip Technology Drawing C04-2133 Rev A

4-Lead Ultra Thin Plastic Dual Flat, No Lead Package (HDA) - 1.25x1.25 mm Body [UDFN] With 0.6 mm Exposed Pad

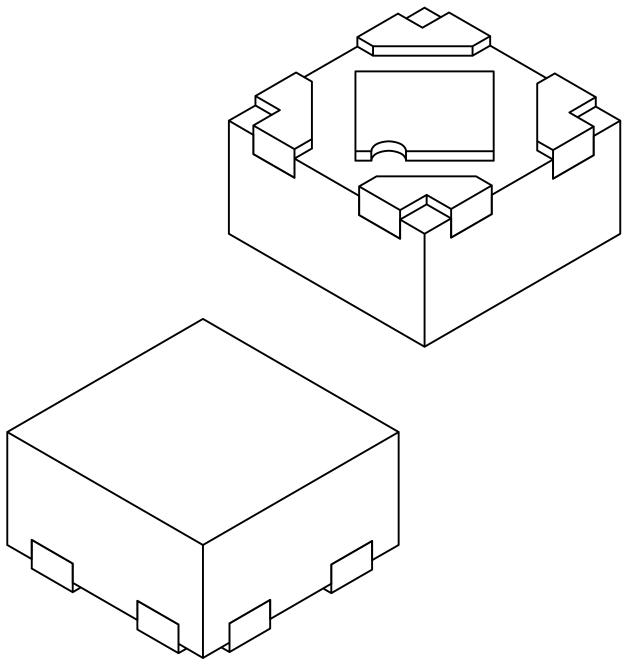
Note:	For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Microchip Technology Drawing C04-1150 Rev A Sheet 1 of 2

4-Lead Ultra Thin Plastic Dual Flat, No Lead Package (HDA) - 1.25x1.25 mm Body [UDFN] With 0.6 mm Exposed Pad

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Number of Terminals	N		4	
Pitch	e		0.65 BSC	
Overall Height	A	0.50	0.55	0.60
Standoff	A1	0.00	0.02	0.05
Terminal Thickness	A3		0.152 REF	
Overall Length	D		1.20 BSC	
Exposed Pad Length	D2	0.55	0.60	0.65
Overall Width	E		1.20 BSC	
Exposed Pad Width	E2	0.55	0.60	0.65
Terminal Width	b	0.20	0.25	0.30
Terminal Length	L	0.20	0.25	0.30

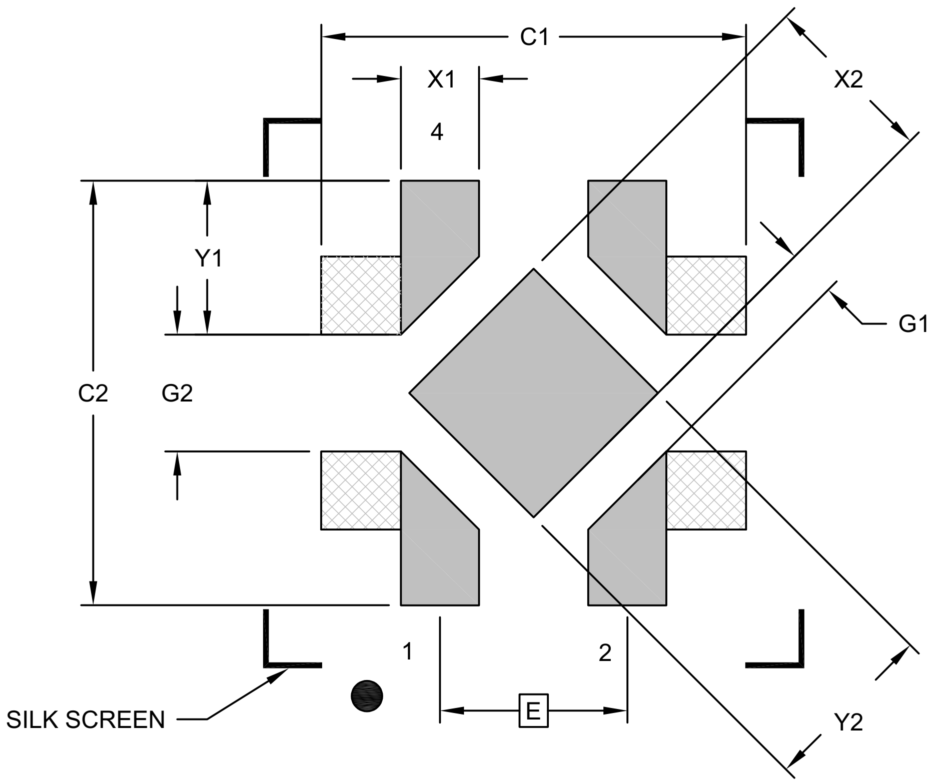
Notes:

1. Pin 1 visual index feature may vary, but must be located within the hatched area.
2. Package is saw singulated
3. Dimensioning and tolerancing per ASME Y14.5M
   BSC: Basic Dimension. Theoretically exact value shown without tolerances.
   REF: Reference Dimension, usually without tolerance, for information purposes only.

Microchip Technology Drawing C04-1150 Rev A Sheet 2 of 2

4-Lead Ultra Thin Plastic Dual Flat, No Lead Package (HDA) - 1.25x1.25 mm Body [UDFN] With 0.6 mm Exposed Pad

Note: For the most current package drawings, please see the Microchip Packaging Specification located at http://www.microchip.com/packaging



RECOMMENDED LAND PATTERN

Units		MILLIMETERS		
Dimension Limits		MIN	NOM	MAX
Contact Pitch	E	0.65 BSC		
Center Pad Width	X2			0.58
Center Pad Length	Y2			0.58
Contact Pad Overall Length	C1		1.40	
Contact Pad Overall Width	C2		1.40	
Contact Pad Width (X4)	X1			0.26
Contact Pad Length (X4)	Y1			0.50
Contact Pad to Center Pad (X4)	G1	0.16		
Contact Pad to Contact Pad (X4)	G2	0.39		

Notes:

1. Dimensioning and tolerancing per ASME Y14.5M

   BSC: Basic Dimension. Theoretically exact value shown without tolerances.

Microchip Technology Drawing C04-3150 Rev A

NOTES:

APPENDIX A: REVISION HISTORY

Revision B (April 2024)

- Updated details for Typical Application Circuits.
- Updated Table 4-1.
- Updated package drawings in Section 6.0, Packaging Information.
- Minor text and format changes throughout.

Revision A (September 2022)

- Converted Micrel document MIC94090/1/2/3/4/5 to Microchip data sheet DS20006706A.
- Minor text changes throughout.

NOTES:

PRODUCT IDENTIFICATION SYSTEM

To order or obtain information, e.g., on pricing or delivery, contact your local Microchip representative or sales office.

PART No.	X	XX	-XX
Device	Junction Temp. Range	Package	Media Type

Device:	MIC94090:	High Side Load Switch with Fast Turn On
	MIC94091:	High Side Load Switch with Fast Turn On and Load Discharge
	MIC94092:	High Side Load Switch with 790 µs Soft-Start
	MIC94093:	High Side Load Switch with 790 µs Soft-Start and Load Discharge
	MIC94094:	High Side Load Switch with 120 µs Soft-Start
	MIC94095:	High Side Load Switch with 120 µs Soft-Start and Load Discharge
Junction Temperature Range:	Y =	-40°C to +125°C
Package:	C6 =	6-Lead SC-70
	MT =	4-Lead 1.25 mm x 1.25 mm UDFN
Media Type:	TR =	3000/Reel (SC-70-6 option only)
	TR =	5000/Reel (UDFN option only)

Examples:

a) MIC94090YC6-TR: MIC94090, -40°C to +125°C Temp. Range, 6-Lead SC-70, 3000/Reel

b) MIC94091YMT-TR: MIC94091, -40°C to +125°C Temp. Range, 4-Lead 1.25 mm x 1.25 mm UDFN, 5000/Reel

c) MIC94092YC6-TR: MIC94092, -40°C to +125°C Temp. Range, 6-Lead SC-70, 3000/Reel

d) MIC94093YMT-TR: MIC94093, -40°C to +125°C Temp. Range, 4-Lead 1.25 mm x 1.25 mm UDFN, 5000/Reel

e) MIC94094YC6-TR: MIC94094, -40°C to +125°C Temp. Range, 6-Lead SC-70, 3000/Reel

f) MIC94095YMT-TR: MIC94095, -40°C to +125°C Temp. Range, 4-Lead 1.25 mm x 1.25 mm UDFN, 5000/Reel

Note 1: Tape and Reel identifier only appears in the catalog part number description. This identifier is used for ordering purposes and is not printed on the device package. Check with your Microchip Sales Office for package availability with the Tape and Reel option.

NOTES:

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