

SOT-23 Current Sensing IC

Features

- VDS(on) or VCE(on) sensing
- Eliminates external current sensing resistors
- Enables inductance-less current sensing
- 600V blocking capability
- Programmability and temperature compensation possible
- No VCC required
- Gate drive on/off sync input
- Filter delay at GATE turn-on (200nsec typ.)
- 20.8V zener clamps on GATE and CS pins
- Integrated ESD protection and latch immunity on all pins
- Tiny 5-pin SOT-23 package

Applications

- MOSFET, DirectFET, or IGBT current sensing
- Over-current protection
- Industrial applications
- Motor control
- Power tools
- Brick converters
- Forklifts
- Induction heating

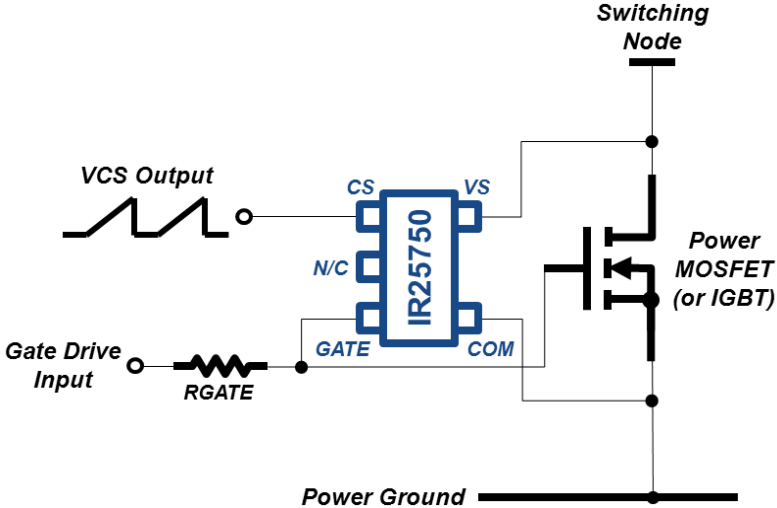
Description

The IR25750L is a novel current sensing IC that extracts the VDS(on) of a power MOSFET, or the VCE(on) of an IGBT, during the switch on-time. IR's proprietary 600V HVIC technology then blocks the high drain voltage to during the MOSFET or IGBT off-time. This IC allows for external current sensing resistors to be eliminated for reducing power losses and increasing overall system efficiency. The IC includes a gate drive input that provides VCC supply voltage to the IC and synchronizes the internal sensing circuit to the on and off times of the switch. Programmability and temperature compensation are also possible.

Package Options



Typical Connection Diagram



Ordering Information

Base Part Number	Package Type	Standard Pack		Orderable Part Number
		Form	Quantity	
IR25750LPBF	SOT23-5L	Tape and Reel	3000	IR25750LTRPBF

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Absolute Maximum Ratings

Absolute maximum ratings indicate sustained limits beyond which damage to the device may occur. All voltage parameters are absolute voltages referenced to COM, all currents are defined positive into any pin. The thermal resistance and power dissipation ratings are measured under board mounted and still air conditions.

Symbol	Definition		Min	Max	Units
V_S	VS pin voltage		-20 [†]	625	V
V_{GATE}	GATE pin voltage		-0.3	V_{CLAMP} ^{††}	
V_{CS}	CS pin voltage				
P_D	Package power dissipation @ $T_a \leq +25$ °C	5L SOT-23	—	250	mW
$R\theta_{JA}$	Thermal resistance, junction to ambient	5L SOT-23	—	191	°C/W
T_J	Junction temperature		-55	150	°C
T_S	Storage temperature				
T_L	IC pin temperature (soldering, 10 seconds)				
			—	300	

† The test condition for the minimum $-V_S$ rating is for a pulse width of 1usec. Larger pulse widths will result in a lower $-V_S$ voltage rating.

†† This IC contains a 20.8V voltage clamp structure between the GATE and COM pins, and, between the CS and COM pins. Please note that this pin should not be driven by a DC, low impedance power source greater than the V_{CLAMP} specified in the Electrical Characteristics section.

Recommended Operating Conditions

For proper operation the device should be used within the recommended conditions.

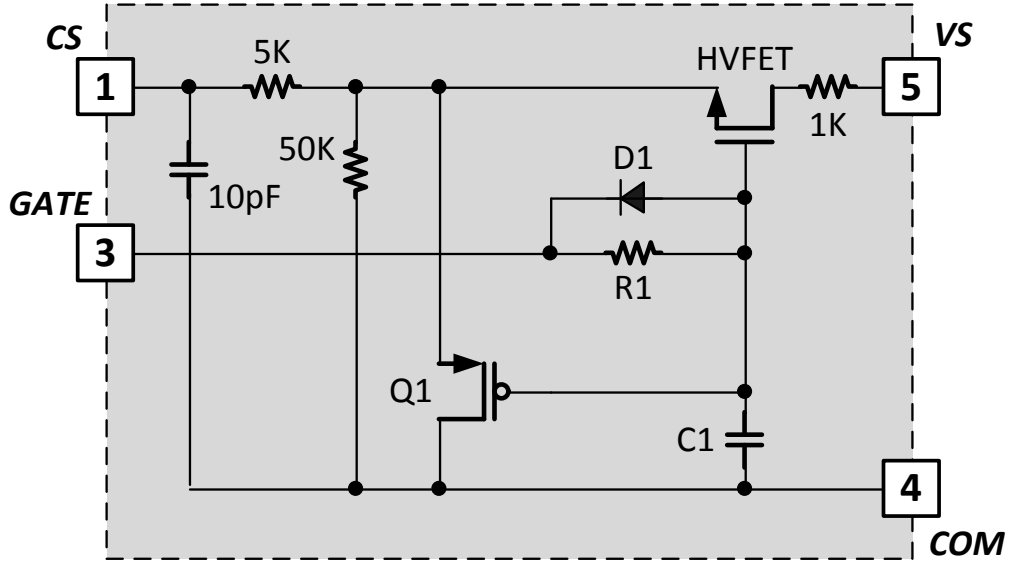
Symbol	Definition		Min	Max	Units
V_S	VS pin voltage		-5.0	600	V
V_{GATE}	GATE pin voltage		COM	V_{CLAMP}	
V_{CS}	CS pin voltage				
T_J	Junction temperature		-40	125	°C

Electrical Characteristics

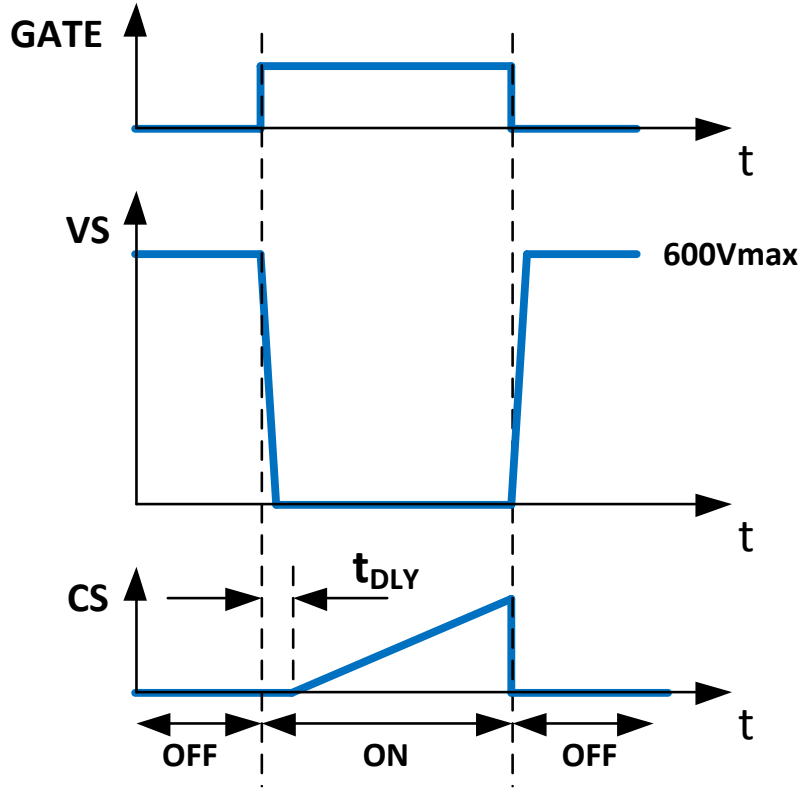
$T_A = 25\text{ }^\circ\text{C}$ unless otherwise specified. All parameters are referenced to COM.

Symbol	Definition	Min	Typ	Max	Units	Test Conditions
GATE Pin Characteristics						
t_{DLY}	GATE-to-CS rising-edge blank delay time	—	200	—	nsec	$V_{GATE} = \text{rising edge}$
V_{CLAMP1}	GATE pin internal Zener clamp voltage	21.1	22.5	24.0	V	$I_{GATE} = 1\text{mA}$
High-Voltage Switching Node Input (VS Pin) Characteristics						
I_{LK}	Offset supply leakage current	—	—	50	μA	$V_{GATE} = \text{COM}, V_S = 600\text{V}$
R_{VS_CS}	VS-to-CS 'ON' resistance	—	6.2	—	$\text{k}\Omega$	$V_{GATE} = 15\text{V}$
CS Pin Characteristics						
V_{CS_LOW}	CS pin voltage during GATE pin 'low' state	—	COM	—	V	$V_{GATE} = \text{COM}$
V_{CLAMP2}	CS pin internal Zener clamp voltage	—	20.8	—		$I_{CS} = 1\text{mA}$

Functional Block Diagram



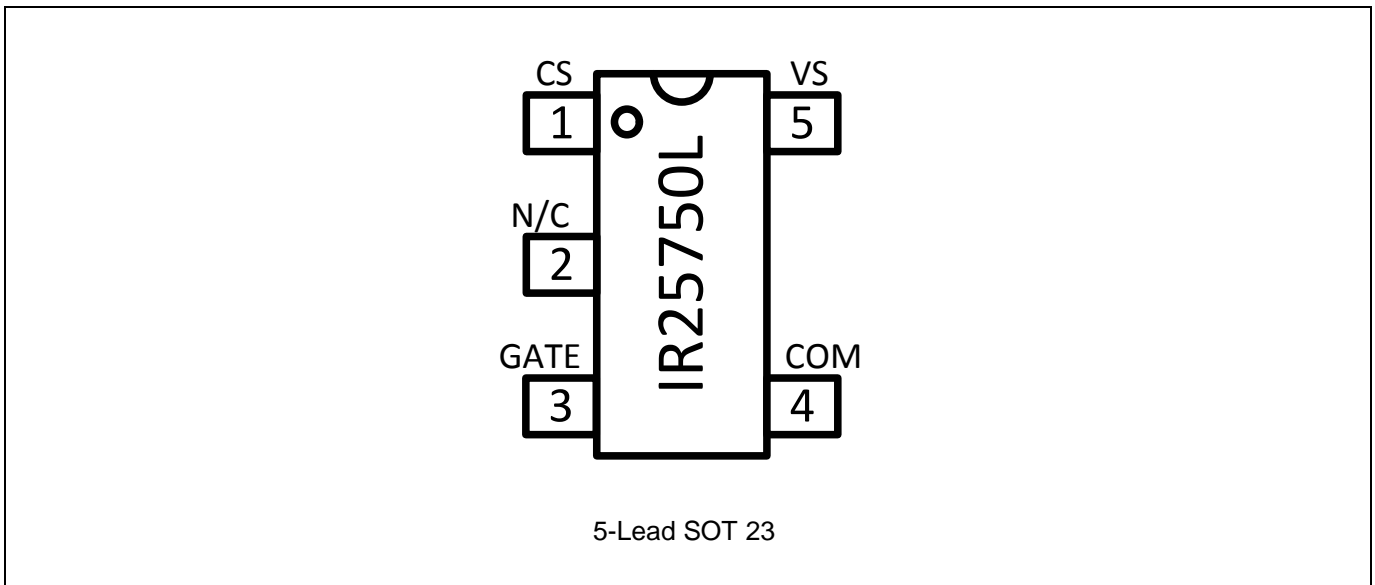
Timing Diagram



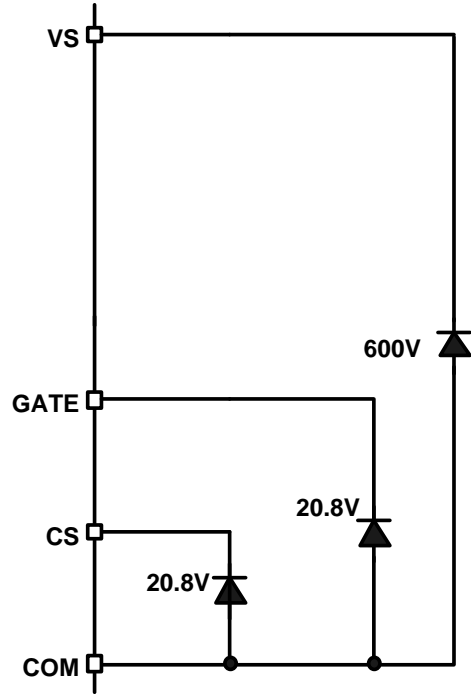
Pin Definitions

Pin	Symbol	Description
1	CS	Current sense output
2	N/C	No connect
3	GATE	VCC supply and on/off sync input
4	COM	IC ground
5	VS	Switch drain or collector input sensing node

Pin Assignments



Input / Output Pin Equivalent Circuit Diagrams



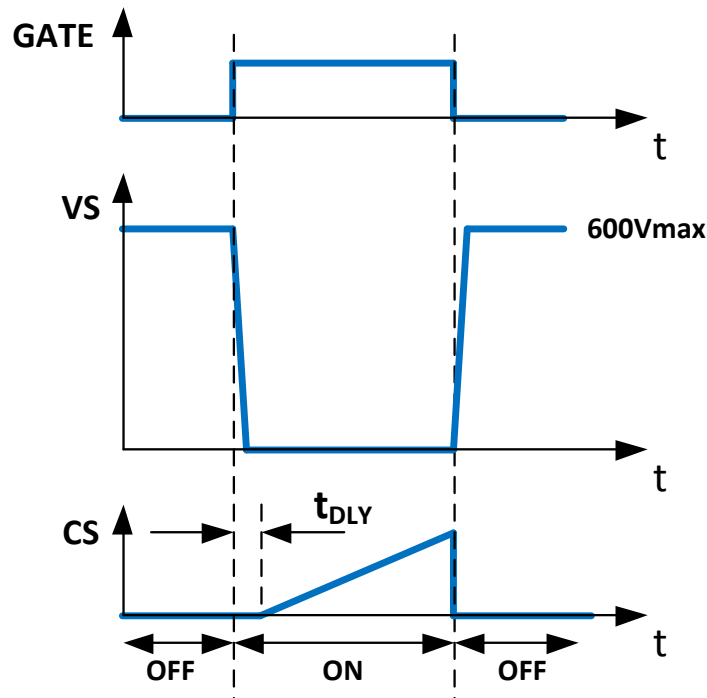


Figure 2: IR25750L timing diagram.

II. PCB Layout Guidelines

Since no VCC node is required for this circuit, the pcb layout becomes very simple to design (**Figure 3**). The IR25750L can be placed conveniently next to the power MOSFET or IGBT and connected easily to the existing pcb traces that are already used for the power switch (GATE, DRAIN, SOURCE). Only the CS trace needs to be routed back to the main PWM controller or MCU of the power supply circuit. Also, important to note, the power ground of the switching circuit must be separate from the COM connection of the IR25750L. The COM pin of the IR25750L should be connected to the source of the power MOSFET with a single trace only, and, the power ground should not be routed through the COM pin of the IR25750L.

A typical pcb layout is also shown for a DirectFET footprint (**Figure 4**). Again, the IR25750L can be placed directly next to the MOSFET and connected to the existing traces.

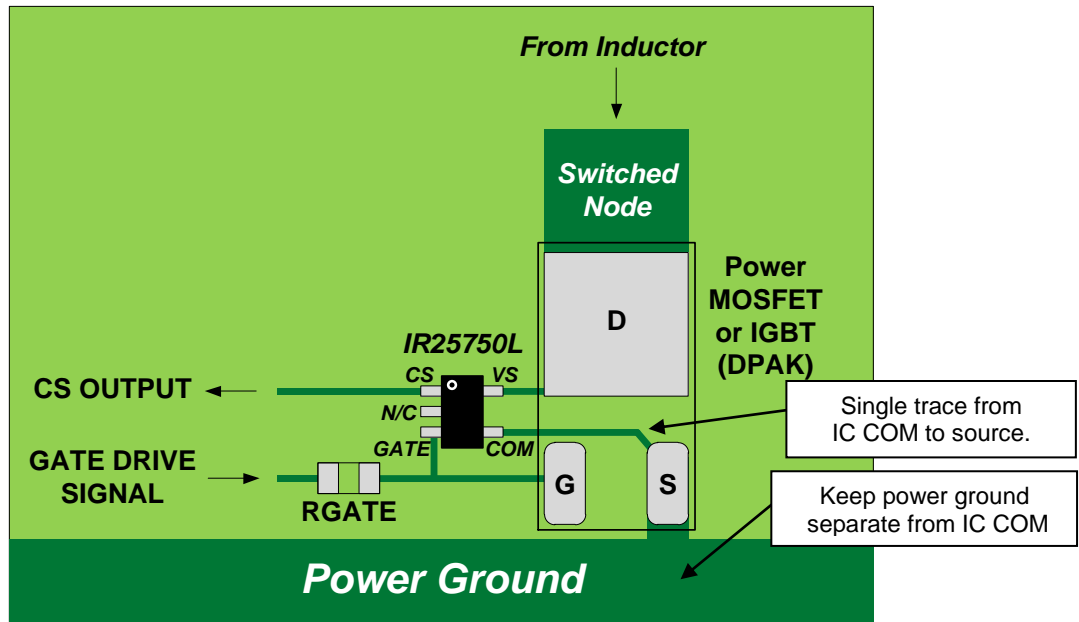


Figure 3: IR25750L typical pcb surface-mount layout (DPAK or D2PAK MOSFET or IGBT).

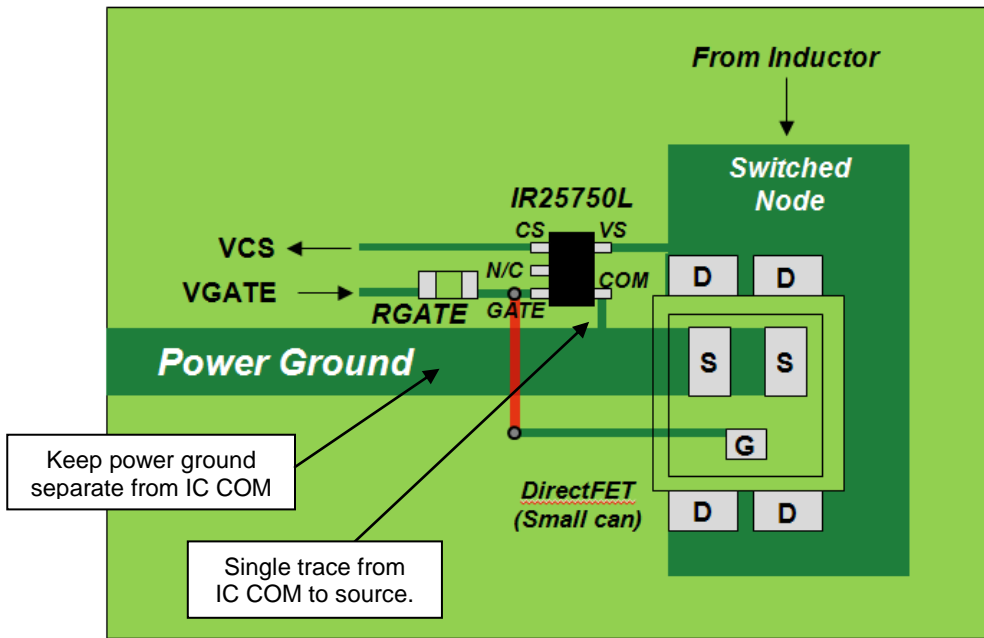


Figure 4: IR25750L typical pcb surface-mount layout (DirectFET).

III. Current Sensing Functionality

With the IR25750L connected properly in a switching circuit application, the waveforms (**Figure 4**) show the functionality of the circuit and the desired current sense signal at the CS pin. Compared to the conventional resistor sensing method, both methods match the actual current shape and both exhibit noise spikes due to switching. Proper filtering or digital blanking of the final PWM or MCU current sensing circuit will easily ignore these noise spikes to prevent any false triggering.

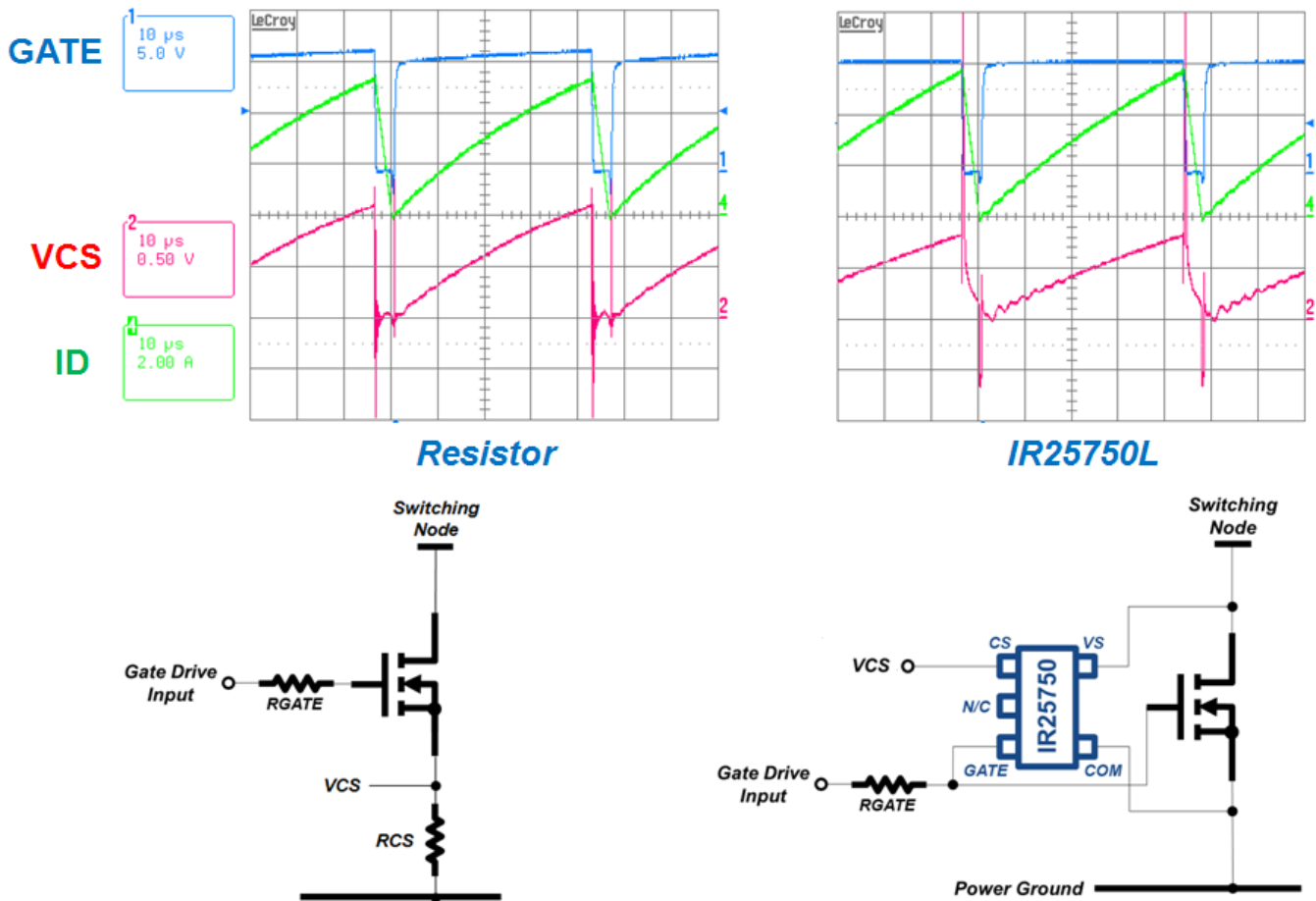
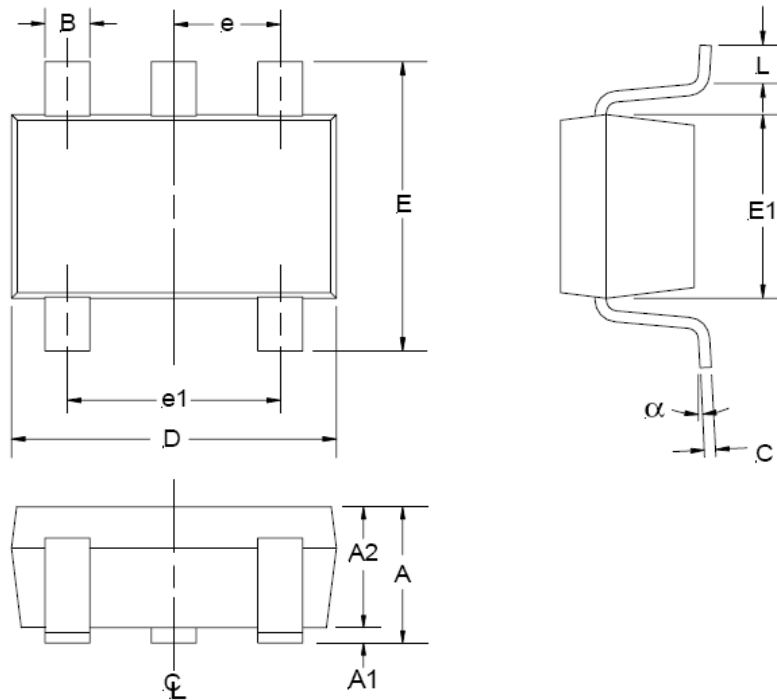
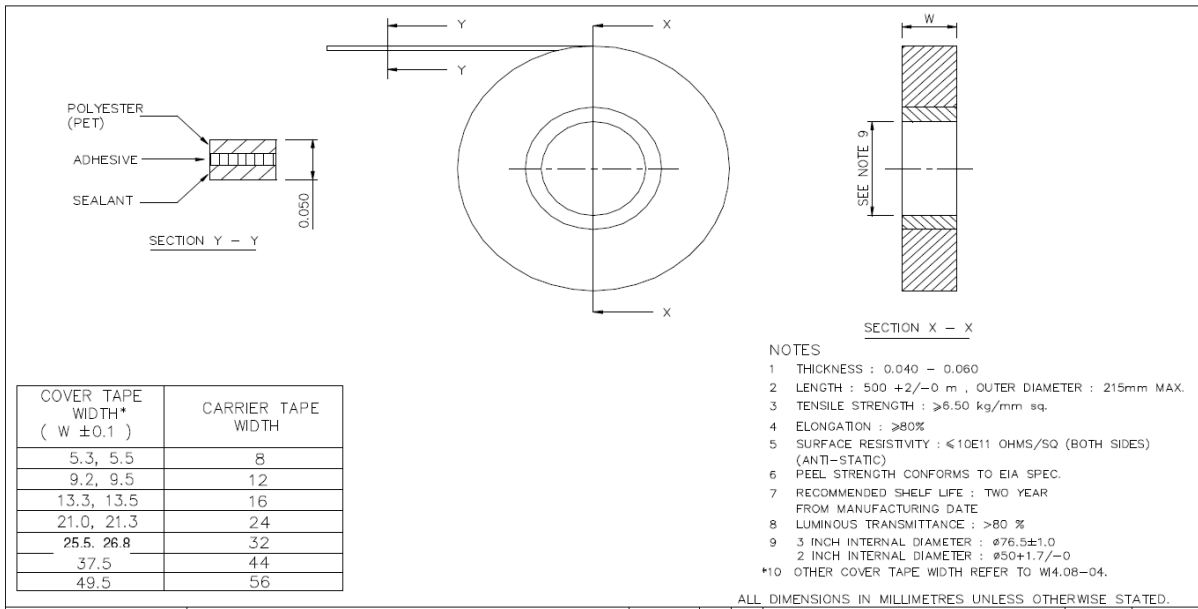
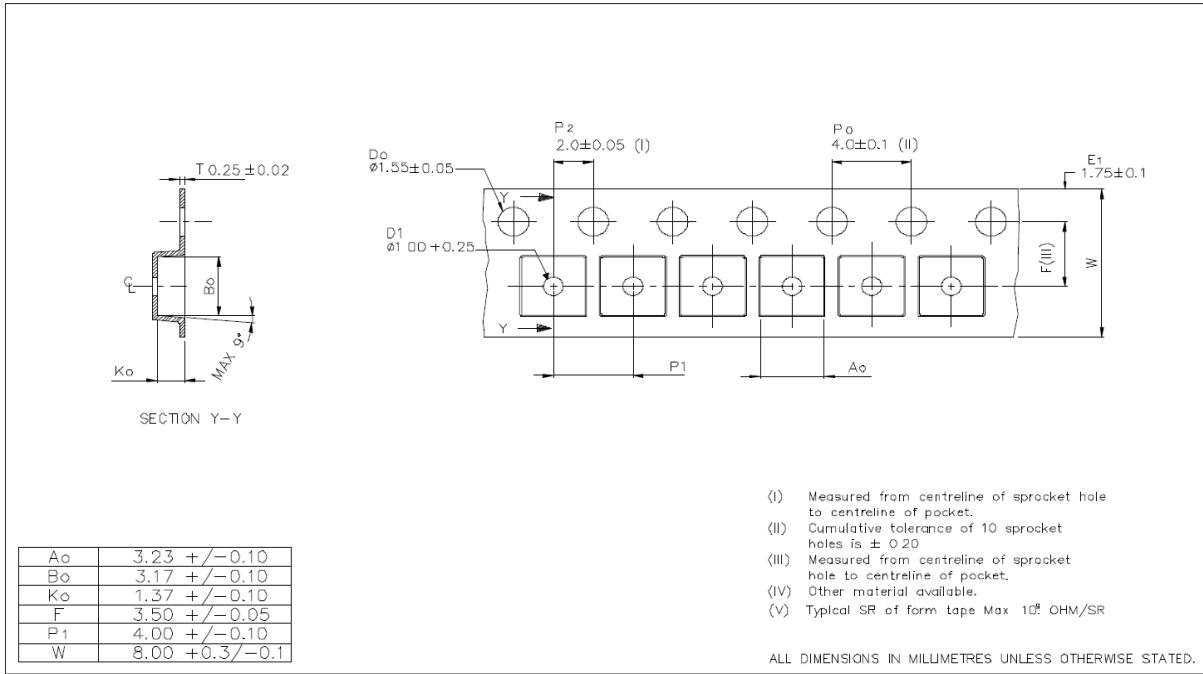


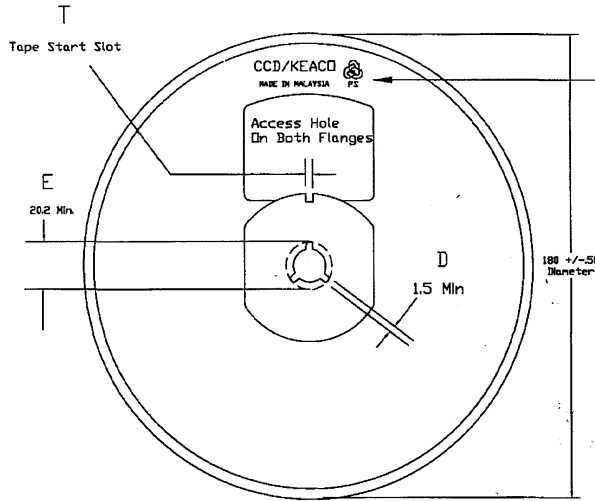
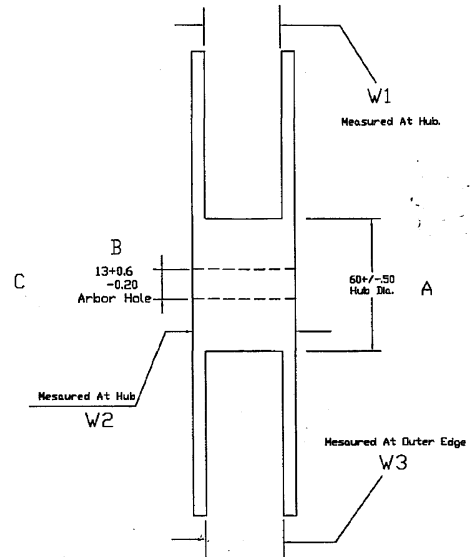
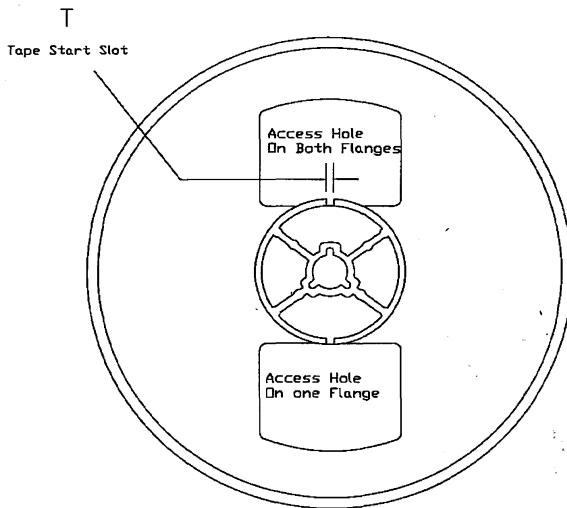
Figure 4: IR25750L switching waveforms vs. resistor method (green=IDRAIN, red=VCS, blue=GATE).
 (RCS=0.21 ohms, RDS(on)=0.18 ohms)

Package Details: 5L SOT-23


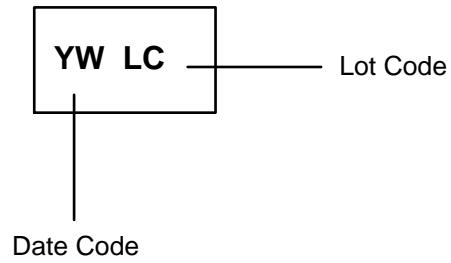
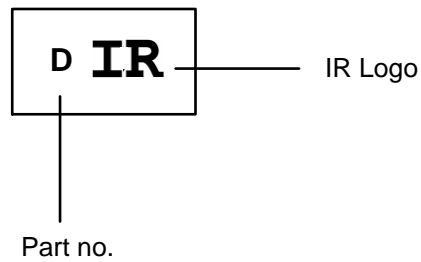
SYMBOL	MIN	MAX
A	0.90	1.45
A1	0.00	0.15
A2	0.90	1.30
B	0.25	0.50
C	0.09	0.20
D	2.80	3.00
E	2.60	3.00
E1	1.50	1.75
e	0.95 REF	
e1	1.90 REF	
L	0.35	0.55
α	0°	10°

NOTE: ALL MEASUREMENTS ARE IN MILLIMETERS.

Tape and Reel Details: 5L SOT-23


Tape and Reel Details: 5L SOT-23

FRONT VIEW

SIDE VIEW

BACK VIEW

- NOTE:**
1. MATERIAL : POLYSTRENE
 2. SURFACE RESISTIVITY : $\leq 10E11$ OHMS/SQ (EXTERNAL OR DIPPED)
 3. STATIC DECAY : < 2 SEC. AT 50%RH

Part Marking Information: 5L SOT-23**Top Marking****Bottom Marking**

Qualification Information[†]

Qualification Level		Industrial ^{††} (per JEDEC JESD 47)	
		Comments: This family of ICs has passed JEDEC's Industrial qualification. IR's Consumer qualification level is granted by extension of the higher Industrial level.	
Moisture Sensitivity Level		SOT-23	MSL1 ^{†††} (per IPC/JEDEC J-STD-020)
ESD	Machine Model	Class A (per JEDEC standard EIA/JESD22-A115-A)	
	Human Body Model	Class 1B (per ANSI/ESDA/JEDEC standard JS-001-2012)	
IC Latch-Up Test		Class I, Level A (per JESD78)	
RoHS Compliant		Yes	

† Qualification standards can be found at International Rectifier's web site <http://www.irf.com/>

†† Higher qualification ratings may be available should the user have such requirements. Please contact your International Rectifier sales representative for further information.

††† Higher MSL ratings may be available for the specific package types listed here. Please contact your International Rectifier sales representative for further information.

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